

PN-ACS-481



Ministry of Agriculture & Land Reclamation  
US Agency For Intl. Development  
Agriculture Policy Reform Program  
Reform Design and Implementation

وزارة للزراعة واستصلاح الأراضي  
الوكالة الأمريكية للتنمية الدولية  
مشروع إصلاح السياسات الزراعية  
وحدة تصميم وتنفيذ السياسات

*Ministry of Agriculture and Land Reclamation*

## **AGRICULTURE POLICY REFORM PROGRAM**

*Reform Design and Implementation Unit (RDI)*

USAID CONTRACT NO. 263-C-00-97-00005-00



**APRP**

*Reform Design and Implementation Unit*

*Development Alternatives Inc. Group: Office for Studies & Finance, National Consulting  
Firm Development Associates, Cargill Technical Services, The Services Group, Training  
Resources Group, Purdue Universities, University of Maryland*

**RDI REPORTS**

*Report No. 118*

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***ENVIRONMENT ASSESSMENT  
TO PROMOTE THE  
SUSTAINABLE DEVELOPMENT  
OF FISHERY RESOURCES IN  
THE NORTHERN DELTA LAKES  
OF EGYPT***

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*August 2000*

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## Acknowledgement

The team wishes to express its gratitude to the numerous people who met with the group in Alexandria, Cairo, Damietta, Matariya, and Port Said to offer their insights and suggestions on how to address the environmental and fishery issues confronting the northern lakes. Governmental Officials from the General Authority for Fish Resource Development (GAFRD), Egyptian Environmental Affairs Agency (EFAA), and the Ministry of Water Resource and Irrigation (MWRI) were extremely helpful in providing historical data on the causes of degradation in the lakes and offering their thoughts on new policy directions and potential solutions to improve the situation. In addition, staff with several USAID projects, including the Egyptian Environmental Policy Program, the Water Policy Reform Program, and the Alexandria Wastewater Project, were ready to assist in every way to provide information and document that have been used throughout this report.

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## PURPOSE

The purpose of this assessment is to examine how the degradation of the four northern lakes of the Nile River Delta has impacted fishery production and the fishing community of the area and to suggest possible approaches and concrete activities that can begin to reverse years of environmental decline. A major goal of the study is to be as practical as possible so that government agencies, non-governmental organizations, and donors can take immediate steps to reverse years of environmental degradation, and over the long term, launch a program dedicated toward environmentally sustainable development of the lakes' resources.

The report initially explores the environmental services that the lakes provide to Egypt and the Mediterranean, and how these services are being degraded by several threats, including water pollution, reduced freshwater allocations, land reclamation, and overfishing. A major theme throughout the report is that the lack of a forum for cooperation between the different government institutions and stakeholders has been a major factor underlying the environmental problems witnessed today. The study then proposes practical tasks to be undertaken over the next five years to achieve a more integrated approach to lake management. The assessment team, which is made up of staff and consultants from APRP/RDI Unit and GAFRD, suggests a development approach and vision that is oriented toward meeting the resource needs of multiple stakeholders and users of the lakes, including fishermen, farmers, city dwellers, and the environment.

To conduct the assessment, team members met with scientists, lake managers, fishermen, environmentalists, and local residents in Cairo and various field sites. Members visited towns and cities around Lakes Manzala and Maryut, including Alexandria, Damietta, Matariya, and Port Said. The team also relied on socio-economic and scientific studies conducted in recent years by various donors, NGOs, and government agencies. Many of the recommendations are based on stakeholder interviews as well as a workshop held in Port Said on June 29.

In the interest of examining the northern lakes with sufficient depth to permit recommendations to be meaningful, the study team decided to focus on Lakes Manzala and Maryut. These two lakes are considered to be under the greatest threat, and therefore require the most urgent action. The team recognizes that the problems discussed in this paper affect all the lakes to one degree or another, and therefore recommendations made for Maryut and Manzala can also be generalized for other lakes -- Burullus, Idku, and even Bardawil.

## Executive Summary

The northern delta lakes of Egypt are under severe environmental threat. Over the last 70 years, the lakes have lost nearly 60 percent of their area to agriculture, urban expansion, and road construction, declining from 641,000 feddans in the 1930s to 280,000 feddans today. They have received untreated municipal sewerage and agricultural run-off from over half of the country's population, from Cairo and Alexandria included. Many of Egypt's largest industries have discharged their untreated or partially treated effluents to drains that flow directly into the lakes. In the near future, allocations of agricultural drainage, which are considered the best water flowing into the lakes, may be reduced sharply as new land reclamation projects come on line and use this water for irrigation. Under these circumstances, it is not an exaggeration to regard the northern lakes as being in crisis.

### *Value of the Northern Lakes*

The deterioration of the four lakes – Burullus, Idku, Manzala, and Maryut – is unfortunate from several perspectives. These waterbodies provide vital environmental, economic, and social benefits to the entire country, as well as to the countries of the Mediterranean basin and Europe:

- ***Serve as Egypt's largest source of fish.*** In 1998, the lakes contributed 28 percent of the Egypt's total fish production and were considered to be one of the most productive estuaries in all of Africa. Lake Manzala, for example, was the single largest source of fish for all of Egypt, surpassing the Mediterranean Sea, the Red Sea, and the Nile River. Northern lake fish were a major source of protein for the people of Egypt, many of whom were from the lowest income levels of society.
- ***Provide passive primary and secondary treatment for Egypt's municipal and industrial wastewater, equivalent to hundreds of millions of dollars in new investments for treatment plants.*** Sanitary drainage from Alexandria, Cairo, Damietta, and numerous other cities and villages enter Lakes Maryut and Manzala in a highly polluted state. Once these waters are mixed with good quality agricultural drainage and undergo natural decomposition processes, these waters enter the Mediterranean meeting water quality standards as if they had received primary and secondary treatment.
- ***Reduce vulnerability to loss or damage of urban and road infrastructure from flooding.*** The lakes play a vital role in reducing vulnerability to natural disasters for Alexandria and other cities by absorbing flood waters from coastal storms. In 1992, Lake Maryut protected Alexandria from severe flooding that threatened property. Furthermore, the lakes help regulate local climate and protect against the desert's encroachment.
- ***Protect northern delta from seawater intrusion.*** The lakes buffer against salt water intrusion of groundwater supplies which currently threatens hundreds of thousands of feddans of agricultural land.

- *Provide habitat of international importance to Mediterranean, European, and Middle Eastern wildlife.* The lakes represent 25 percent of the Mediterranean's wetland area. Lakes Burullus is designated as area of international importance under the Ramsar convention for conserving wetlands, and areas inside Burullus and Manzala are protectorates within Egypt's parks system. The lakes are a critical wintering and staging area for some 500,000 migratory birds which use them as the first rest stop after crossing the Mediterranean Sea from Europe. Among these birds, the entire European and West-Asiatic breeding populations of the little gull and whiskered tern rely on the lakes.

Looking to the future with expected higher global temperatures, the lakes may well play a critical role in reducing vulnerability to sea level rise and to more frequent and intense coastal storms. However, also looking to the future, these environmental services may well vanish. Given past and present development practices and trends, the current trajectory of environmental decline indicates that Lakes Maryut and Manzala will disappear altogether in the coming decades, perhaps as early as in the next 20 years. The lakes may become mere drainage canals for the country's growing population.

### *Costs of Environmental Degradation*

The monetary and social costs to Egypt should the lakes be further degraded or disappear should not be underestimated. They may include the unemployment of as many as 670,000 fishermen and people working in support services, as well as the loss of an income source for about 2 million of their family members. Environmental decline may result the loss of the country's most important source of fish, particularly for its low-income citizens, which potentially will impact nutritional levels. The fishing community has already suffered significant loss to their earnings as a result of the lakes' poor environmental quality. In Lake Maryut, for example, annual fish production has fallen from 156,000 tons in 1958 to a low of 1,900 tons in 1990. Fishermen report that a day's catch used to yield hundreds of kilograms of fish. Today, daily yields range from two to ten kilograms.

Furthermore, with predictions that the country will experience at least a 150 percent increase in the volume of sewerage over the next 20 years due to population growth, the loss of the lakes will mean that this sewerage will need to flow somewhere else, perhaps directly into the Mediterranean Sea or to the desert. For the nations of the Mediterranean, the costs could be increased pollution reaching the sea as well as habitat loss of important migratory birds. Other impacts may include salt water intrusion of groundwater supplies, potentially making newly reclaimed lands unsuitable for agriculture. Cities and infrastructure would become more vulnerable to coastal storms and sea-level rise.

### *Underlying Factors Leading to Environmental Degradation*

The reasons for the degradation of the lakes are well known to the resource managers, fishermen, scientists, environmental groups, and other concerned citizens. This assessment finds that five principal factors have led to the current state of the northern lakes:

- Fisheries and the lakes' other environmental services have been undervalued in an economic and social sense by policy makers and planners.

- A fragmented approach to decision making has been used in which individual government sectors view the lakes as inputs into their specific programs. As a result, a lack of consensus exists on their fundamental development and management objectives. In certain cases, laws and decrees impacting the lakes contradict each other and create confusion for local authorities trying to enforce these laws.
- National, gubernatorial, and local public institutions working in and around the lakes have been poorly coordinated on basic management activities and policies.
- Decisions regarding the future of the lakes and daily management activities have not involved the citizens who rely on them for their livelihoods.
- Basic data on the state of the lakes and fishery effort are either difficult to access or non-existent, leading to misunderstanding about the lakes' condition and to difficulties in using scientific information for resource management.

The team finds that the lakes have not been managed to maximize their economic and social returns or to meet the needs of multiple stakeholders. Instead, they often have been managed as receptacles for the country's wastes. After years of being polluted and reclaimed, this management approach has essentially become self-fulfilling.

### *Recommendations for the Sustainable Development of Fishery Resources*

In spite of the current crisis, the assessment team finds that several factors point to a favorable outcome for mitigating these threats and even achieving a degree of restoration. The lakes are flushed out rapidly, thus washing away polluted waters quickly. Modest efforts to date to remove weeds and open up channels to improve water circulation have already yielded positive results. In Lake Maryut, for example, fish production is on an upswing from a low of 1,900 tons per year in 1990 to 5,240 tons in 1999. Experiences in the United States and other parts of the world show that highly degraded lakes and coastal areas can be restored if given a chance. A favorable outcome, however, is contingent on decision makers and stakeholders reaching consensus that the northern lakes are worth saving, and on relevant institutions finding a mechanism to work together to coordinate their programs.

To change the current path of environmental degradation, the assessment team strongly recommends that decision makers adopt an integrated coastal zone management (ICZM) approach to manage the lakes. ICZM has been embraced by countries around the world which have confronted similar resource use conflicts. The goal of ICZM is to achieve environmentally sustainable development. ICZM relies on analyzing the implications of development, conflicting uses, and relationships between environmental, economic, and social processes. Ultimately, ICZM aims to promote linkages and harmonization between the different sectoral activities and goals.

To place the management of the northern lakes under an ICZM approach, the assessment team recommends a two-phased approach. In the short term, for the next two years or so, efforts should be directed toward mitigating the impacts of current environmental threats and reducing the emergence of new threats. Over the medium term, the goal needs to be adopting

and institutionalizing integrated management to support the lakes' restoration and their sustainable development to meet the needs of multiple stakeholders, including fishermen, farmers, cities, and the environment.

In more concrete terms, the team lays out a series of short-term objectives and activities that Egyptian policy makers, lake managers, fishermen, and citizens need to pursue:

***Objective 1 – Improve institutional coordination.***

A critically important aspect of improving the lakes' environmental quality is to achieve better institutional coordination between the different ministries, central and local governments, and stakeholders. The goal needs to be to move away from the current situation where different sectors and stakeholders do not interact with each other to a situation they discuss, coordinate, and harmonize existing and future policies. Specific actions proposed by the assessment team include establishing an inter-ministerial committee for the northern lakes to ensure high-level decisions take the lakes' interests into account, strengthening and expanding membership of local lake committees as a forum for coordinating programs and management activities at the local level, and engaging local and national non-governmental organizations in lake management.

***Objective 2 – Cease all land reclamation.***

Land reclamation has already claimed a large share of the lakes and threatens to completely dry over Maryut, Idku, and Manzala. Suggestions to address this threat include adopting a new decree from the Ministry of Agriculture and inter-ministerial committee forbidding further drying, reviewing and modifying currently approved and pending drying schemes, and establishing procedures to identify and penalize violators.

***Objective 3 – Maintain sufficient freshwater allocations.***

Ensuring that the northern lakes receive a minimum flow of good quality freshwater required to maintain basic ecological processes must be one of the highest short-term priorities. Specific proposed tasks include achieving consensus on long-term freshwater allocations for lakes with the Ministry of Water Resources and Irrigation, and identifying appropriate actions (ie, dredging canals) to mitigate the impacts of imminent water diversion projects.

***Objective 4 – Mitigate the impacts of pollution.***

In the foreseeable future, the lakes will continue to receive high loads of wastewater that reduce water quality and fish production. Steps need to be taken to mitigate these impacts, including identifying priority actions based on severity of threat (i.e., dredging drainage canals and lake bottom to enhance water circulation and to increase water depth, removing emergent vegetation clogging the canals, installing aerators); securing financial resources to implement these actions; and monitoring key water quality parameters with sufficient frequency.

***Objective 5 – Reduce effluents from priority point sources.***

The assessment finds that some point sources of pollution are more harmful than others. While an inventory of existing industries has been conducted, it is unclear whether a list of priority point sources has been prepared for future action. Focussing on the worst polluters for the short term will provide the most environmental benefit for each unit of effort. Specific actions include updating the inventory of current point sources and identifying

pollution "hotspots" for priority action, inspecting priority industries, and pursuing appropriate action to reduce discharges. Wherever possible, pollution abatement should also seek to achieve greater production efficiencies and economic returns.

*Objective 6 – Support sustainable fishery production*

Ultimately, achieving higher earnings from the lakes' biological resources will be a powerful argument to use to defend them. Although the northern lakes have been under severe environmental pressure for years, they still have considerable potential for increased fish production and recreational use. Specific proposals include strengthening local fishing cooperatives so they can facilitate technical assistance, training, and financing to fishermen; improving property rights over fishery resources to provide an incentive structure for their long-term stewardship; increasing the profitability of northern lake fish; and enforcing fishery laws.

*Objective 7 – Conserve Biodiversity*

The biological diversity of the lakes is of international importance. Given the present decline of the lakes and the need to find economic approaches to justify their continued existence, an effort should be launched to promote eco-tourism for national and international visitors. The opportunity to put the northern lakes on the itinerary of tourists already coming to Egypt and the Mediterranean Sea should be explored. The establishment of a no-take zone for preservation would not only support conservation goals, but also contribution to sustainable fish production.

Over the medium term, to ensure that the long-term development and environmental goals of the lakes are reached through a systematic and integrated perspective, the assessment team recommends that a comprehensive management planning process be launched for ICZM. The purpose of this planning process would be two-fold: achieve consensus from all stakeholders on future policies and activities in the lakes, and provide a simplified road map to deal with a very complicated and dynamic situation. The development of such a management plan would be part of a broader process commonly accepted throughout the world to support integrated management of coastal resources. The team recommends that the Government of Egypt approach the donor community to request financial and technical support for a long-term program in the northern lakes.

Over the long term, the presence of a management plan that is developed and implemented through a transparent, participatory, consensus-building process will go a long way to help focus future programs toward mutually-reinforcing goals. The aim of such a plan, and indeed future management efforts, should be to promote fisheries and development of the lakes' natural resources and environmental services in a way that benefits the people of Egypt today and for future generations to come.

## Section I

### Introduction

#### Importance of Northern Lakes for the Sustainable Development of Egypt

The northern delta lakes provide many economic, environmental, and social benefits to the people of Egypt and the Mediterranean. Some of these benefits are easy to quantify. For example, the 1998 catch from the four lakes – Burullus, Idku, Manzala, and Maryut – amounted to LE 1.05 billion, or roughly 35 percent of the country's total fish income. The lakes currently provide passive primary and secondary treatment of wastewater that would be equivalent to hundreds of millions of dollars worth of new treatment plants. Other important and valuable benefits are much harder to quantify. It is unknown how much property damage and economic dislocation Lake Maryut prevented in 1992 when Alexandria experienced severe flooding, or how much the lakes contribute to agricultural production by buffering against seawater intrusion of groundwater supplies. Beyond Egypt, it is difficult to value the benefit these wetlands provide to sustain migratory birds of the entire Eastern Mediterranean/Black Sea region. In the future, with predicted sea level rise and the frequency of coastal storms on the increase, the lakes may be even more important to prevent natural disasters.

Although the value of the lakes' environmental services are hard to quantify, it is not an understatement to claim that their benefits accrue to the entire nation:

##### *Egypt's largest source of fish.*

The northern lakes are the single most important source of fish in Egypt. In 1998, landings from the four lakes amounted to more than 152,000 tons, represent about 28 percent of the national fish landings. Northern lake fish such as tilapia and catfish are the least expensive source of animal protein available in the country, and therefore are a major source of protein for Egypt's low-income citizens. In 1998, Lake Manzala was the largest single source of fish in Egypt, accounting for more than 14 percent of domestic supply and more than 40 percent of private and public fish farm production. Nearly 3 million people rely directly on fish production for income. This figure includes approximately 170,000 fishermen, 500,000 people providing support services, and over 2 million family members. Cities such as El Matariya and Damietta depend on fish production as a principal source of income. In the future, to meet the country's demand for fish, the 1997 - 2012 National Development Plan relies heavily on the lakes to increase production to a target of 212,000 tons annually.

##### *Cleanse Egypt's agricultural, municipal, and industrial drainage.*

The northern lakes currently serve as oxidation ponds that treat much of Egypt's drainage water flowing from major cities and agricultural areas of the country. Water entering the lakes are often highly polluted with organic materials, industrial chemicals, and human pathogens. The lakes' biological and physical processes work with incoming agricultural drainage to remove these harmful substances. By the time the water flows into the Mediterranean Sea, it meets generally accepted water quality standards.

As agricultural drainage has become less polluted with harmful pesticides and herbicides, fish have been able to take advantage of the heavy loads of nutrients for food. This, in effect, has given agricultural drainage another "reuse" of water that typically would no longer be suitable for irrigation. With current predictions that the construction of new treatment plants will not be able to keep pace with the rate of growth of sewerage, the lakes' ability to neutralize drainage water will be all the more important. Without the treatment capacity of the lakes, sewerage may need to be discharged directly into the Mediterranean or transported to the desert.

Although the lakes currently function as passive wastewater treatment ponds for much of Egypt's municipal and industrial effluents, this function has a high opportunity costs in terms of losses to fish production, human health, and environment quality. In addition, it is unclear whether the flow of greater quantities of pollution will exceed the lakes' already stretched capacity to process this waste.

*Prevent saltwater intrusion of Nile groundwater supplies.*

Seawater threatens to make the northern delta and Nile River aquifer more saline, creating the problem of soil salinization for agriculture. While the hydrological dynamics of this process are complex and require further study, scientists know the northern lakes play a vital role in preventing seawater intrusion. They act as a buffer between seawater and freshwater in the aquifer, and ensure that salinization of northern farmland is minimized. Without the northern lakes, seawater intrusion of groundwater supplies would be more severe.

*Reduce vulnerability to damage from coastal flooding.*

The lakes act as a natural defense against flooding, particularly for Alexandria, Damietta, and Port Said. As storms hit the coast, excess water runs off into the lakes instead of to the streets of these cities. The lakes' ability to reduce vulnerability to disasters saves millions of dollars in terms of preventing property damage and disruption to business and people's lives. Indeed, some experts regard Lake Maryut's most important role as a sponge for Alexandria's floodwaters. They contend that the 1992 floods would have been much more destructive without the lake's presence. During this time, the lake absorbed millions of cubic meters of flood waters that otherwise would have inundated the city's streets and houses. They consider the loss of the lake as serious threat to the entire city's well-being. In the coming years, as global climate change leads to more frequent and intense coastal storms and to sea level rise, coastal communities may rely even more on the lakes to absorb flood waters.

*Regulate local climate.*

Scientists also believe that the northern lakes regulate the local climate and act as a barrier to the encroachment of the desert into major cities and coastal towns. Due to the lakes presence, Alexandria and Port Said, for example, are generally cooler than they otherwise would be without the lakes. Equally important, Alexandria does not suffer from sand storms due to Lake Maryut.

*Habitat vital to Mediterranean biodiversity.*

The northern lakes are of very high biodiversity value to the Mediterranean, Europe, and the Middle East. Comprising 25 percent of the entire Mediterranean basin's wetlands, the lakes are home to rare aquatic habitat that include reed swamps, salt marshes, sand flats, open water, and island ecosystems. Migratory and endangered species, as well as resident species, are dependent on the health of these wetlands. The Egyptian and international conservation community have recognized the importance of the northern lakes by declaring Lake Burullus as a wetland of international importance under the Ramsar convention, an international treaty

**Background on the Northern Delta Lakes**

**(NEED MAPS OF THE NORTHERN LAKES, and of Manzala and Maryut)**

All the northern lakes share several similar physical and biological traits. They are all surrounded by the densely cultivated delta land and all function as receptacles for agricultural drainage and extra irrigation water. Except for Maryut, the lakes depend on natural and artificial openings to the sea to facilitate water exchange and maintain water quality. Drainage water flows out and seawater flows in with the tide and volume of drainage. As a result of this dynamic, the lakes have a unique succession of salt, brackish, and freshwater characteristic of estuaries. They all are shallow, ranging on average from 0.7 meters to 1.6 meters, and are highly productive. Islands are scattered through the lakes. Lake Manzala has 1,022 islands that cover 33,000 feddans. Lake Maryut does not share these characters. It receives the drainage water that is mechanically pumped out to the sea to maintain the lake at 2.8 meters below sea level, which is the level required to prevent flooding of surrounding areas.

**Lake Maryut**

Lake Maryut is the smallest of the northern lakes and perhaps the most threatened. It is divided into five essentially independent basins created over the years as roads, navigation and drainage canals, dykes, and railroad tracks were built to cross the lake. The largest and most productive basin is called the 6,000-feddan basin, which produces mostly freshwater fish, predominately tilapia. The smallest basin is less than 1,000 feddans. Maryut receives sewerage water mixed with industrial effluents from the city of Alexandria. It also receives agricultural drainage from the western delta area. Land reclamation for urban and industrial development and the impacts of water pollution are critical threats to the lake.

**Lake Manzala**

Lake Manzala is the second largest lake in Egypt and, until a few decades ago, was considered to have supported one of the richest aquatic ecosystems in all of Africa. Despite its serious decline in recent years, the lake remains one of the Egypt's most important fisheries. In 1998, annual fish production of 78,000 tones represented 14 percent of the total harvest in Egypt. Egyptians caught more fish in Lake Manzala than from any other fishery. Despite its high productivity and important contribution to the Egypt's food security, the lake is in decline. environmental quality, although several threats also jeopardize their status. In addition, Lake Bardawil, Egypt's most pristine lake, may follow the same pattern of environmental decline as the delta lakes due to the development of the North Sinai. Lake Bardawil is a Ramsar wetland of international importance. It provides spawning areas for Mediterranean fish and wintering and migratory staging habitat to 500,000 birds. It hosts the northern-most population of flamingos in the world.

The assessment team finds that four major threats, discussed in greater depth in Section III, endanger the environmental integrity of the lakes:

- **Reduced freshwater agricultural drainage allocations.** The diversion of billions of cubic meters of good quality freshwater drainage from Lake Manzala and the other lakes to meet the irrigation needs of newly reclaimed lands under the North Sinai Development

Project and the Toshka Project will fundamentally change the lakes chemical, biological, and hydrologic dynamics. The lakes will become significantly more polluted and saline.

- *Land reclamation.* Over the last 70 years the lakes have lost nearly 60 percent of their area to agriculture, urban and industrial expansion, and road construction, declining from 641,000 feddans in the 1930s to 280,000 feddans today.
- *Water pollution.* The lakes receive untreated municipal and industrial sewerage from more than half the country's population. Approximately 180 of Egypt's largest industries discharge untreated or partially treated effluents directly into drains that flow into the lakes. As a result, eutrophication, sedimentation, and chemical contamination is a serious problem.
- *Overfishing.* The lakes are under pressure from overfishing and illegal fishing beyond maximum sustainable yields. The viability of future fish production is at stake.

The impacts of these threats are obvious. Fishermen and their families have been impoverished. Hazardous chemicals and human pathogens, released to the open environment, threaten public health. Fisheries have not been managed to achieve their maximum sustainable yield. The number of migratory birds visiting Lakes Maryut and Manzala has fallen dramatically. Lands that were reclaimed for agriculture lay vacant or have been converted to fish farming.

The causes leading up to today's situation are very complex and diverse: Public institutions are poorly coordinated. The lakes' economic and environmental services are difficult to measure and therefore are undervalued. The general public and decision makers are unaware of the importance of the lakes to Egypt's development. Basic management objectives for the lakes contradict each other. Fishermen and advocates in favor of protecting the lakes are poorly organized and politically weak. Basic environmental and fisheries data for management do not exist.

## Section II

### Institutional Coordination and Governance of the Northern Lakes

The policy and institutional environment in which fisheries management of the northern lakes operates is highly complex and dynamic. It involves about 16 government ministries, numerous governorates, and a multitude of laws and decrees. Ecologically, the lakes are equally complicated. Much of the freshwater entering the lakes originates thousands of kilometers to the south in the Ethiopian highlands or Sudanese swamps. These waters pass through practically all of Egypt's agricultural lands and cities along the world's longest river, pick up domestic and industrial wastewater from Cairo and other cities and municipalities, to finally enter the lakes, where, within a few weeks to several months, the waters flow into the Mediterranean Sea. Stakeholders encompass a wide spectrum of Egyptian society, from subsistence farmers and fishermen, to the citizens of Alexandria and Cairo, to the country's largest industries. Gaining consensus on how to manage these lakes and coordinating the various institutional actors that have a stake in their welfare is no easy task.

One of the assessment's main findings is that resource-use conflicts confronting the lakes today are in large part due to difficulties in achieving coordination within this complex setting. Three institutional factors lie at the core of the difficulties encountered in the lakes today:

- Within government circles, a lack of consensus exists on the value of the lakes and the basic development and management objectives.
- Decision-making processes have been centralized and sectorally oriented. As a result, basic management actions between different public institutions have been poorly coordinated, particularly at a national and regional levels. The lack of coordination has created contradictory laws and policies.
- Little local consultation has been conducted to develop policies in a way that receives stakeholder support and ownership.

As discussed in this section, conflicts over how the lakes should be developed have emerged due in large part to the inability of current management approaches to meet the multiple needs of the lake's resource users within a transparent and participatory decision-making process. The northern lakes lack an institutional framework to ensure that management proceeds through an integrated approach that can optimize resource allocations for the common good for local communities and for Egypt, while also protecting the environment and its natural resource base for future generations. Given this institutional void, it is not surprising that the northern lakes confront serious environmental and development problems. The study finds that coordination has been weak in three principal areas described below.

#### **Intersectoral coordination**

Currently, intersectoral or "horizontal" coordination among the various ministries working in the northern lakes is weak, particularly within the central ministry offices in Cairo.

Horizontal coordination is based on the understanding that water and coastal ecosystems are valuable natural resources that often must meet multiple uses rather than serve as inputs to a specific sectoral activity. Such coordination seeks to promote greater integration of agricultural, municipal, industrial, fishing, and environmental users in the interest of promoting more equitable and efficient resource allocations.

### *Coordination in Cairo*

In the case of the northern lakes, key ministries and decision makers in Cairo highlighted in Table 1 have little contact with each other on basic management issues. Instead, policies that impact the lakes typically are made through internal discussions and processes, or in consultation with just one or two other ministries, rather than with all involved ministries. Even though the General Authority for Fish Resources Development (GAFRD) was established in 1983 to develop the lakes' fish resources, it often does not participate in decision making on basic policy impacting the lakes.

**Table 1**

<b>Institutional Roles and Responsibilities for the Environment and Fisheries in the Northern Lakes</b>	
Ministry of Agriculture and Land Reclamation	<ul style="list-style-type: none"> <li>• Conservation of agricultural lands, wildlife, and biological resources.</li> <li>• Regulates pesticides</li> </ul>
<ul style="list-style-type: none"> <li>• General Authority for Fish Resources Development (GAFRD)</li> </ul>	<ul style="list-style-type: none"> <li>• Manages Egypt's fisheries resources for all inland and coastal waters</li> </ul>
<ul style="list-style-type: none"> <li>• General Authority for Rehabilitation Projects and Agricultural Developments (GARPAD)</li> </ul>	<ul style="list-style-type: none"> <li>• Reclaims desert and northern lake areas for agriculture.</li> </ul>
Egyptian Environmental Affairs Agency (EEAA)	<ul style="list-style-type: none"> <li>• Monitors compliance and coordinates enforcement of environmental laws, particularly on air pollution, hazardous substances, waste management, and discharge to marine waters.</li> <li>• Set requirements for all environmental impact assessments.</li> <li>• Manages natural protectorates and the coastal zone.</li> <li>• Promotes environmental education.</li> </ul>
Ministry of Water Resources and Irrigation	<ul style="list-style-type: none"> <li>• Protects all public water resources, including the Nile, lakes, springs, and groundwater.</li> <li>• Regulate and control sources of water pollution.</li> <li>• Sets and enforces water quality standards and discharge limitations, inspects facilities causing water pollution, and advises polluters on reducing effluents.</li> </ul>
Ministry of Health and Population	<ul style="list-style-type: none"> <li>• Public health and control of environmental health problems.</li> <li>• Sets standards for water quality</li> <li>• Protects drinking water supply</li> </ul>
Ministry of Housing and Sewerage	<ul style="list-style-type: none"> <li>• Provision of water supply, sewerage collection and treatment, and solid waste management.</li> <li>• Sets standards for wastewater discharge to public sewers</li> <li>• Enforces water quality standards</li> </ul>
Ministry of Industry	<ul style="list-style-type: none"> <li>• Licenses all private sector industries.</li> <li>• Supervises pollution control, safety, and health issues</li> <li>• Ensures new plants have adequate water treatment</li> </ul>
Ministry of Interior	<ul style="list-style-type: none"> <li>• Under the Inland Water Police, takes enforcement action on environmental laws</li> </ul>
Local Authorities/Governorates	<ul style="list-style-type: none"> <li>• Regulates solid waste management</li> </ul>

As a result, central ministries tend to make policy decisions regarding the lakes with a view toward achieving their own objectives within their particular sector:

- The agriculture, housing, transportation, and industrial ministries essentially view the lakes as available land that can be reclaimed for productive uses within their areas of interest.
- The water resource sector regards the lakes as extensions of the Mediterranean Sea in which water flowing to the lakes is counted within Egypt's present water accounting systems as wasted or lost. Current water policy calls for maximizing the number of times water can be reused until the water is of such low quality as to be rendered unusable for irrigation, whereupon it can be discharged to the lakes and then the sea.
- Upstream municipalities and industries view the lakes and the drains that flow into them as inexpensive channels to remove their garbage and wastewater. Their discharges cause Lake Manzala and Maryut to be polluted, which gives these lakes a bad public image in the eyes of communities situated around them.
- Fisheries view the lakes as a common property resource in which fish catch should be maximized in the short run, thus leading to overfishing.

One result of this lack of horizontal coordination is that the laws, decrees, and policies that govern the lakes are often contradictory and confusing. It is well known that most fishery and environmental laws are not implemented and that violations are common, particularly by government entities or authorities. Various government agencies have issued their own body of laws and decrees that taken together across all government sectors say different things. As a result, each government agency follows a different law or decree on the same issue. Thus, one ministerial decree may prohibit the reclamation of the lakes, while another decree approves reclamation of certain parts of the lakes. The absence of an organizing body to bring greater coherence to this system means that different authorities, even within one single ministry, may embark on contradictory activities.

Weak inter-ministerial cooperation is also an obstacle to implementing current environmental laws in the lakes, presented in Table 2. Environmental management responsibilities are shared by a wide array of ministries and governorate offices as illustrated in Table 3. Implementing the country's laws requires a high degree of cooperation among a variety of ministries. As many as 16 ministries, and many more offices within these ministries, are responsible for developing or enforcing various environmental laws. However, without an overall coordinating authority for the lakes, enforcement of environmental regulations is conducted in a piecemeal way. Inevitably, gaps exist. For example, on the issue of industrial pollution, the Cairo offices of GAFRD and the EEAA have little interaction with each other on reducing harmful discharges to the lakes.

Lax enforcement of current environmental laws is one of the greatest concerns expressed by fishermen. According to a 1998 report by USAID's environmental policy project, difficulties in implementing environmental laws is a much broader national problem.

"Egypt's record in implementing and enforcing these laws is mixed. With limited exceptions, violations of the environmental laws go undetected and requirements go largely unendorsed.

This is true for a number of reasons. Firstly, monitoring and enforcement responsibilities under the environmental laws are often fragmented among regulatory institutions, licensing agencies, policy authorities, etc. at both the national and governorate levels of government to the effect that no single institution can take enforcement action

Table 2. Institutional Roles and Responsibilities for Environmental Management

### Water Quality and Pollution Control

	EEAA	MHUNC	MOH	MWRI	MOI	Governorate
<b>Issuing Standards</b>						
Groundwater			■			
Surface water			■			
Drainage		■				
Control	■					
<b>Licensing</b>						
Drainage to sewer						■
Drainage to land				■		
<b>Monitoring</b>						
Groundwater			□	■		□
Drained to sewer		□				■
<b>Enforcement</b>						
Law 4	■				□	
Law 48				■		
Law 93						■

■ - Lead Responsibility; □ - Supportive responsibility

EEAA - Egyptian Environmental Affairs Agency; MHUNC - Ministry of Housing, Utilities, and New Communities; MOH - Ministry of Health; MWRI - Ministry of Water Resources and Irrigation; MOI - Ministry of Interior;

### Hazardous Substances and Waste Management

	EEAA	MOIND	MOME	MOH	MHUNC	MOI	Governorate
<b>Issuing Standards</b>							
Substances	□	■		□			
Controls		■					
Transportation		□		■			
Treatment, storage, disposal facilities			■		■		
<b>Licensing</b>							
Handling/transport		■					
Treatment facilities	■						■
Disposal facilities					■		
<b>Monitoring</b>							
Generation	■	□					
Treatment, storage, disposal facilities	■	□					
Storage Site	■	□					
Enforcement	■	■				□	

effectively. Secondly, this fragmentation of responsibilities necessitates a high degree of inter-agency coordination for effective management, yet few formal mechanisms for such coordination exist. Coordination, if it occurs, is informal at best. Third, the limited institutional structure and inadequate capacity in most environmental agencies, at both the national and governorate level, places a real constraint on effective compliance monitoring and enforcement."<sup>2</sup>

The report continues that environmental management is also hampered by the limited authority of the Egyptian Environmental Affairs Agency's (EEAA) to enforce the law.

"Law 4/1994 does not give the EEAA any licensing authority for implementing environmental standards (this authority remains with the traditional sector ministries whose licenses do not routinely incorporate environmental conditions or requirements), nor does it give the EEAA authority to take administrative responsibility in enforcing actions against violations of the law or its regulations (there is no authority to impose a penalty or to order corrective action without going to court). The law requires the EEAA to use the traditional legal process, i.e., report the violation to the police, present it to the district attorney, and, where the case warrants further action, to bring a legal action to court. Given the Egyptian legal system, however, with its tremendous backlog of cases and lack of experience with complex environmental issues, there is no reason to expect this legal process to support timely and effective enforcement of the law."<sup>3</sup>

### *Local Coordination*

Fortunately, positive steps have been taken locally level to coordinate management activities between some key ministries. GARFD has organized a formal committee for each lake to bring together officials from local branches of ministries to discuss basic management issues. The committee typically meets monthly to tackle issues dealing with the daily operations and maintenance of the lakes.

The committee in Lake Maryut appears to be particularly active and successful in achieving a degree of local coordination. Members from the Institute of Oceanography and Fisheries, the Environment and Water Police, MWRI, and EEAA actively participate in discussions. However, two major obstacles limit the committee's effectiveness. First, committee members contend that current centralized decision making gives them limited authority to make policy on basic management directions. Because the ministries in Cairo do not coordinate policy, the local lake committee must contend with often contradictory policies to implement. In addition, the members claim that several representatives from such key ministries as housing and industry do not participate in their meetings, although they officially are members. Thus, local coordination is limited to only those ministries that actively participate in the committee. These two factors mean that the lake committee has little influence in deciding major policy directions on such issues as land reclamation, sewerage treatment, and industrial pollution.

Even gaining cooperation from the five governorates that surrounded Lake Manzala in the 1990s has been problematic. (Due to land reclamation, only three governorates currently surround the lake). Efforts by these five governorates to form an executive coordinating committee failed to progress when consensus could not be reached on several basic issues.

**Table 3. Principal Environmental Laws, Decrees and Regulations**

<b>Environmental Law</b>	<b>Date</b>	<b>Authority</b>	<b>Decrees/Regulations</b>	<b>Implementing Agency</b>
Law No. 4 on Environment	1994	Establishment of EEAA & Environmental Trust Fund; requirement of EIA, regulation of air pollution	Decree No. 338 of 1995 (Executive Regulations)	Ministry of State for Environmental Affairs EEAA
Law No. 117 on Cultural Heritage	1983	Preservation & management of cultural heritage	Presidential Decree No. 2828 of 1971 (cultural heritage)	Ministry of Culture SCA
Law No. 102 on Natural Protectorates	1983	Designation & management of natural protectorates	Decrees designating sites	MOEA EEAA
Law No. 124 on Fisheries	1983	Management & protection of fisheries & marine animals		Ministry of Agriculture and Land Reclamation
Law No. 48 on Protection of Nile and its waterways	1982	Control of pollution of surface waters	Decree No. 8 of 1983 (standards for waste water discharges to surface waters)	Ministry of Public Works and Water Resources
Law No. 137 on labor	1981	Control of work place safety & environment		Ministry of Manpower and Immigration
Law No. 27 on Public Water Sources	1978	Protection of public work sources for drinking & domestic purposes	Decree No. 27 of 1966 (Supreme Committee for Water) Annex IV of 1975 (Standards for potable water)	Ministry of Health and Population Supreme Committee for Water
Law No. 31 on Public Cleanliness	1976	Control of solid waste management (amends Law No. 38 of 1967)		Ministry of Housing, Utilities, and Urban Communities
Law No. 66 on Transport Air Pollution	1973	Control of air pollution from transportation sources	Decree No. 864 of 1969 (Supreme Committee) Decree No. 470 of 1971 (ambient air standards)	Ministry of Health and Population Supreme Committee for Protection of Air
Law No. 38 on Public Cleanliness	1967	Control of solid waste management (including hazardous waste)	Decree No. 134 of 1968 (waste from domestic & industrial sources)	Ministry of Housing, Utilities and Urban Communities
Law No. 53 on Agriculture	1966	Regulation of purchase, importation & handling of pesticides	Decree No. 50 of 1966 (registration & licensing requirements)	Ministry of Agriculture and Land Reclamation

Law No. 93 on Wastewater and Drainage	1962	Control of waste water discharges & drainage to public sewers	Decree No. 643 of 1962 (standards for waste water discharges to public sewers)	Ministry of Housing, Utilities and Urban Communities
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Source: EPIQ Project, 1998

### **Intergovernmental or "vertical" coordination.**

Current decision making processes in the lakes also are weak with regard to their ability to achieve "vertical" coordination. Vertical coordination ensures that the unique roles and responsibilities assumed by different levels of government are integrated and cohesive, and that local stakeholders participate meaningfully in policy formulation and implementation. The role of the central government, for example, is to set the basic policy, legislative, and regulatory frameworks in achievement of national development goals. Responsibilities of governorate and local governments are to translate these policies into programs that are built on local needs and knowledge. The role of stakeholder involvement in management decision making, implementation, and enforcement is increasingly recognized as critical to successful environmental management. Stakeholder participation creates a sense of ownership over policies. Plus, resource users have valuable insights regarding management needs and potential economic opportunities that can increase the effectiveness of policies.

In the northern lakes, an effective structure for vertical coordination has yet to be fully formed. While the local lake committees have access to GAFRD officials in Cairo, they state that they have little power to influence policy concerning such major issues confronting the lakes as water allocations or land reclamation. Similarly, local fishermen say that no formal procedures or mechanisms exist in which they can influence policy. They express an interest in becoming a member of the lake coordinating committees as one way of being consulted on lake management.

In general, local fishing cooperatives have little political power in the northern delta. Most are under-funded and poorly coordinated among themselves. Egypt's 93 fish cooperatives and its union which represent 200,000 licensed fishermen provide a variety of social services and credit, and lobby on behalf of fishermen nationwide. The fishery union and northern lake cooperatives have conducted a variety of lobbying activities over the years that include meeting with representatives of the People's Assembly, central ministries, and governorates. However, they claim their low status and poor organization makes these lobbying efforts largely ineffective.

The issue of vertical integration goes beyond the involvement of just fishermen. Many people interviewed say that the real decisions concerning the lakes are made at the highest levels of government with no local consultation. Because decision making is a closed process, these people are frustrated and feel powerless. Fishermen claim that their voices are only heard when they threaten to strike. In Alexandria, for instance, plans to reclaim 6,000-feddan basin, the most productive part of Lake Maryut, were partially abandoned the fishermen waged a strike. Because the fishing community views decision making as being political driven, they are highly mistrustful of the government, both at the governorate and central levels. They generally view GAFRD positively. They claim that GAFRD, too, lacks access to decision makers.

The Friends of the Environment of Alexandria has taken a different strategy to influence local policy making, relying on the courts to enforce environmental laws. To date, the NGO has won all of its cases, preventing city parkland from being converted for development, and saving historic buildings from demolition. The NGO has periodically brought concerned citizens together to examine how the lake can be protected, and plans in the near future to release a publication on restoring Lake Maryut.

While the current policy formulation process is centralized, some Cairo-driven policies that would favor the lakes' restoration and fisheries production have had great difficulty getting implemented in the field. In particular, Law 4 for environmental protection, which was passed in 1994, is widely regarded as having a weak track record. In Lake Maryut where industrial pollution is a serious issue, local environmental and fisheries officials estimate that between 40 percent to 60 percent of the factories are not in compliance with the law. Several obstacles exist. The EEAA has lacked a local presence until very recently which could take the lead in implementing the law. In addition, because many industries, often publicly owned, operate at a financial loss or with very low profit margins, they are unable to pay for environmental remediation.

### **Ecological Coordination.**

Ultimately, sustainable fisheries and development of the northern lakes will require designing and planning policies and programs in accordance with ecological characteristics of the area. This approach often means that an ecosystems management perspective to planning and implementation that uses the river basin as the basic management unit.

In the case of the northern lakes, achieving greater ecological integration requires that upstream and downstream users have open channels of communication. It also means that the central government should equitably balance the requirements of all resource users. To date, however, downstream users of Nile waters have had little interaction with their upstream colleagues. Upstream users often treat the Nile's water as a free good for irrigation and drainage. The costs of poor water resource management, however, has inevitably been borne by downstream users. Without appropriate mitigation measures, future development programs, such as the North Sinai and the Toshka projects, discussed in Section III, will have highly detrimental impacts on current downstream communities that depend on this water.

## Section III

### Environmental Issues Limiting Fish Production

Evidence of poor institutional coordination and differing visions of the lakes' fundamental purpose emerge clearly when examining individual environmental and fishery problems, such as water allocation and pollution, land reclamation, and unsound fishing practices. This section reviews the current state of these problems and identifies how poor horizontal, vertical, and ecological coordination has contributed to, and in several cases caused the lakes' current predicament. The impacts on the fishing community, including significantly lower incomes and exposure to disease, are described. This section also paints a troublesome picture for the lakes' future based on predictions by water resource experts of new policies and emerging trends. With several major threats looming, particularly major reductions of freshwater flows and large increases in sewerage entering the lakes, immediate attention needs to be placed on how to mitigate these threats to prevent fundamental and irreversible ecological change.

#### 1. Water Allocation

Ensuring the northern lakes receive a sufficient amount of good quality agricultural drainage is essential for maintaining the stability of fisheries and the lake ecology. To date, however, no policy exists to guarantee minimum freshwater flows reach the lakes. This means that the lakes are subject to variable allocations and cannot depend on receiving the minimum amount of freshwater required to maintain basic fisheries and ecological functions. With major land reclamation projects in construction for the North Sinai and for Toshka, future allocations are projected to be drastically reduced.

The four lakes rely on water from four sources: seawater, agriculture drainage, surplus irrigation water, and sanitary drainage. Agricultural drainage and seawater are the two largest sources of water, while sanitary drainage and irrigation water contributions vary from one lake to another. Of the 52.4 million m<sup>3</sup> of agricultural drainage that enters the lakes daily, the largest volume goes to Lake Manzala, followed by Lakes Burullus, Idku and Maryut. Lakes Manzala and Maryut also receive large volumes of sanitary drainage. Agricultural drainage to Lakes Maryut and Manzala has been essential for diluting municipal and industrial sewerage that also enters the lakes. With the exception of Lake Maryut, the northern lakes obtain variable amounts of seawater depending on the weather and inlet conditions.

Over the last 50 years, the lakes have experienced significant hydrological changes. Before the Aswan Dam, the Nile discharged 90 billion m<sup>3</sup> of fresh water into the sea each year. A considerable share of this water flowed through the northern lakes, flushing out saline water and wastes accumulated since the last flood period while also depositing sediments along the way. With the dam and availability of water year around, irrigated agriculture and land reclamation increased greatly. For the northern delta, the increase in upstream lands under cultivation resulted in large increases in the volume and frequency of agriculture drainage reaching the lakes, particularly during the period from 1960 to 1980. The lake environment changed from being largely marine, with periodic flushing of freshwater, to one that is largely

fresh to brackish. Similarly, the composition of species changed accordingly. The introduction of agricultural waters with high nutrient loads supported the fishery with a new source of food.

Under the current system, the Ministry of Water Resources and Irrigation (MWRI) classifies water entering the northern lakes as a major outflow or a loss to the Nile water system. The ministry views the lakes as part of the disposal system, in the same category as the Mediterranean Sea or water lost to evaporation. Due to this classification, the MWRI places no value on water entering the lakes and does not plan for water delivery to them. Instead, the lakes receive what water remains after all other upstream uses -- irrigation, industrial, navigation, and municipal -- are satisfied. Currently, 12.4 billion m<sup>3</sup> of water flows to the Mediterranean and northern lakes for the express purpose of preventing salt water intrusion of groundwater supplies. According to the scenarios planned under the 2002 – 2017 National Development Plan, this outflow will be reduced to between 6 billion m<sup>3</sup> to 10 billion m<sup>3</sup>.

According to an analysis conducted by USAID's Water Policy Reform, minimum annual drainage outflow needed to preserve freshwater fisheries of the lake is 8.5 billion m<sup>3</sup>. This analysis states,

“The freshwater fisheries in the northern lakes depend on the entrance of the drainage outflows of the Delta for nutrient supply and lake water flushing. The use of the drainage outflow in fish production is a beneficial water use, as valuable as land-based agricultural crop irrigation. The economic value of the fish production in the northern Delta needs to be recognized.”<sup>44</sup>

The issue of water allocation is particularly relevant with respect to the North Sinai Development Project. This project currently uses approximately 200 million m<sup>3</sup> annually of the drainage water that once flowed to Lake Manzala. The project is also responsible for reclaiming 220,000 feddans of land that largely was part of Lake Manzala, and will reclaim another 400,000 feddans in the North Sinai. Once the North Sinai project is complete in about two years, 2 billion m<sup>3</sup> of water from Bahr Hadous and Serw drains will be diverted from Manzala to the El Salam canal annually for irrigation. The assessment team found that impact of diverting 2 billion m<sup>3</sup> of agricultural drainage for the North Sinai from Lake Manzala has not been discussed nor analyzed between the MWRI, GARFD, local lake committee, or fishermen. Because the potential diversion of agricultural drainage is not well publicized, many local people have little awareness of the subject.

One likely scenario presented by USAID's Water Policy Reform Program, which works in the Ministry of Water Resource and Irrigation under APRP, in a 1998 report predicts dramatic changes to the lake's hydrology, chemistry, and biology. Under the scenario presented in Table 4, drainage inflows to Manzala would be reduced by 47 percent from the Serw and Bahr Hadous drains, from 4,219 million m<sup>3</sup> to 2,219 million m<sup>3</sup>. No water from the Bahr el Baqar drain, which is considered too polluted for irrigation, would be diverted. The net effect would be that the freshwater that does enter the lake will be more polluted.

**Table 4. Predicted Water Allocations to Lake Manzala Following North Sinai Development Project**

Drain	1993-94 (million m <sup>3</sup> percent share of total)	After Water Diversion (million m <sup>3</sup> percent share of total)
Bahr el Baqar	1157 (27%)	1157 (52%)
Bahr Hadous and Serw	3062 (73%)	1062 (48%)
Total	4219	2219

As table 5 shows, lake salinity would increase by as much as 90 percent, effectively changing the brackish wetland to a saline waterbody. (Under this scenario, Lake Manzala would be more saline than seawater). It is unclear what impacts fish stocks or vegetation would incur, although clearly organisms less tolerant of salt water would disappear. With less freshwater entering the lake, there would be less water to dilute the heavily contaminated waters of Bahr el Baqar. The lake's flushing time would be reduced by 62 percent. This reduction would signify that the lake would become more polluted as less higher quality freshwater enters the body to dilute incoming sewerage. Clearly, the ecology of the lake would be fundamentally altered as would fish species composition and production. For the fishermen who are unaware and unprepared for this major diversion of water, the economic consequences could be large.

**Table 5. Projected Impacts of Drainage Water Reduction to Lake Manzala**

1993-94				Projected Impacts After Water Diversion			
Drainage outflows volume (million m <sup>3</sup> )	Lake outflow to Mediterranean (million m <sup>3</sup> )	Lake salinity (ppm)	Flushing time (times/yr.)	Drainage outflows volume (million m <sup>3</sup> , % change)	Lake outflow to Mediterranean (million m <sup>3</sup> , % change)	Lake salinity (ppm, % change)	Flushing time (times/yr., % change)
4,219	3,253	2,043	3.4	2,219 (-47%)	1,253 (-61%)	3,886 (+90%)	1.3 (-62%)

Source: EPIQ Water Policy Reform Program, p. 2-8 and 2-9

The issue of water allocations will in all likelihood get even more complicated as the Toshka project comes on line. This project is designed to reclaim 1 million feddans in the southwest desert over the next 20 years. The project is divided into two stages to bring 500,000 feddans under irrigation. In total, the Toshka will require 8 billion m<sup>3</sup> of water each year, withdrawn equally from deep groundwater aquifers and from Lake Nasser. Water used for the Toshka project will not re-enter the Nile system due to its distance away from the valley. According to water planners, to compensate for this 4 billion m<sup>3</sup> loss to the Nile water budget, significant increases in irrigation efficiencies will need to be achieved. At the same time, net outflows from the Nile to the northern lakes and Mediterranean will need to be cut. Scenarios projecting the amount of outflows that will be reduced between 17 percent to 50 percent from current outflows of about 12.4 billion m<sup>3</sup> per year, to 6 billion m<sup>3</sup> to 10 billion m<sup>3</sup> each year. Given that the northern lakes currently are the principal routes by which Nile waters flow to

the Mediterranean, the potential of such drastic cuts, on top of water diversions for other land reclamation projects such as the North Sinai, will in all likelihood be very serious.

Until now, institutions that have been involved with managing the lakes with respect to water allocations, such as the MWRI and GARFD, have not met to discuss this looming issue or to discuss how the impacts of these large water diversion projects can be mitigated.

## 2. Water Pollution

Water pollution is a major problem in Lakes Manzala and Maryut. Their locations next to large cities and towns, coupled with their low gradients, make them likely choices to receive drainage water, especially since most government ministries consider the lakes to be receptacles for wastes. Today, after decades of pollution streaming in from hundreds of industries and municipalities, the lakes are commonly regarded as public health hazards and environmental disasters. Their low value makes them vulnerable for land reclamation, urban expansion, and road construction.

### *Municipal waste*

Over the last 20 years, pollution from sanitary drainage and solid waste has grown significantly. With wastewater treatment facilities unable to keep pace with rapid population, more sewerage enters the lakes. The impacts have been exacerbated as the lakes get smaller by land reclamation. Thus, the volume of waste entering the lakes on a per feddan basis has effectively doubled or even tripled over the last decade. This same phenomena has occurred with solid waste. The lakes are regarded as inexpensive places to dispose of solid waste, particularly as land prices have increased in recent years. The extensive use of plastics and other materials that are not biodegradable has made the situation worse.

Municipal wastes in the lakes has major direct and indirect impacts on fish production and the environment. Water quality is highly degraded in several hotspot areas of the lakes. On occasion, mass fishkills and reduced growth and propagation rates result. Indirectly, fish quality from the lakes is considered inferior, resulting in lower prices for fish and reduced income for fishermen.

### *Industrial waste*

Heavy metals, volatile organic compounds, and PCBs produced through a variety of industrial processes are known to harm fish, wildlife, and humans through long-term cumulative exposure. In the northern lakes, industries discharge partially treated or untreated liquid, solid, and gaseous waste directly into the lakes and their airshed. Industrial waste also reaches the lakes indirectly through public sewerage. The problem of industrial pollution is controversial. In the 1980s, high levels of heavy metals and pesticides were reported in Lake Maryut fish. More recent studies in Lakes Maryut and Manzala contradict these findings and reveal that the fish meet accept levels for the general public consumption, although exposure levels to these chemicals are found to be excessive for populations that have a high intake of the fish. Local fishermen report that fishkills periodically occur near Damietta in Lake

Manzala and just outside the Lake Maryut petroleum refinery when large amounts of industrial effluents are disposed.

### *Agricultural waste*

Although agriculture drainage is considered to be of inferior quality for fish production, fishermen considered it to be the best source of water available in the lakes. In the past, agriculture drainage was heavily polluted with pesticides and herbicides. However, concentrations have declined significantly over the last decade. Herbicides have been replaced with mechanical and biological controls to eradicate weeds in the drainage system. Persistent pesticides such as DDT have been replaced with less toxic chemicals and with biological controls. At the same time, new agriculture practices have required that more fertilizers to be applied. The overall impact has been that nutrient concentrations have increased while harmful agrochemicals have decreased. Accordingly, agricultural drainage has contributed to increases in fish production. Indeed, fish production should be considered as a legitimate "reuse" of agricultural drainage water. Compared to industrial and municipal waste, agricultural drainage is not regarded as a threat to the northern lakes.

In addition, agricultural drainage has been essential for diluting inflowing sewerage to Maryut and Manzala to ensure that water entering the Mediterranean is of acceptable quality. According to the project director for USAID's wastewater treatment project in Alexandria,

"The Main Basin of Lake Maryout is an important element in the present wastewater treatment system for the City of Alexandria. Primary treated wastewater discharged to the Main Basin, either directly or indirectly, is significantly upgraded in its passage through the lake by natural processes of sedimentation, biological activity, nutrient uptake, and bacteriological decay. The very large, shallow (1 meter deep) lake is in effect an oxidation pond and mixing basin which blends the effluent discharges with the much greater agricultural drainage flows before both are pumped to the West Harbor through the El Mex Pump Station. The quality of the resulting blend is in many respects higher than the agricultural drainage prior to mixing."

### **Coordination issues**

Several ministries are responsible for water quality, including the ministries of housing and sewerage, environment, water and irrigation, agriculture, industry, public health, interior, and justice; the Supreme Committee of Water; and the governorates. Under Environment Law 4, all industries needed to fall into compliance by February 1998. A two-year extension was later permitted. To date, enforcement of laws for ensuring water quality have been inconsistent. According to one analysis, the enforcement of environmental regulations is dependent on the power and interest of the responsible ministry, as well as the interest of the local governorate. Confusion exists regarding environmental enforcement authority. A study by USAID's Egyptian Environmental Policy Program states,

"To date, implementation and enforcement of Laws 93/1962 and 48/1982 have not been effective for protecting the Nile and other surface waters from serious

pollution. Some of the wastewater discharge standards issued under the laws are viewed as overly ambitious, while other standards are much too lax or inconsistent. For these and other problems, these water pollution laws have yet to be effectively enforced.”<sup>6</sup>

## Situation Analysis

### *Lake Manzala*

Lake Manzala has gained a reputation as being highly polluted. Five drains – Bahr el Baqar, Hadous, Serw, Matariya, and Fariskur – carry much of the Eastern Delta’s industrial, municipal, and agricultural wastewater directly to the lake. The 106-km Bahr el Baqar, which serves an agricultural area of over 750,000 feddans, as well as the cities of Cairo and various smaller cities and towns along its route, has been identified by Egypt’s 1992 National Environmental Action Plan as one of seven pollution “black spots”. From Cairo alone, Bahr el Baqar receives 1.35 million m<sup>3</sup> of wastewater daily from approximately 6 million people. Untreated or partially treated effluents from 53 large factories and hundreds of smaller workshops also enter the Lake Manzala waste stream, mostly through Bahr el Baqar, which outfalls to the southeast sector of the lake. These large industries run a wide gamut of sectors: textiles (17 factories), detergents (9), milk products and beverages (7), metal (5), fibers and rubber (4), gases (3), caning (3), dyeing (2), glass (1), paper (1), and plastics (1).<sup>7</sup>

The northwest sector of the lake, commonly known as the 30,000-feddan basin or the Deeba Triangle, is also highly polluted. The combination of 0.5 million m<sup>3</sup> of untreated wastewater from Damietta through the El Sayalla drain with poor water circulation following the construction of the Damietta-Port Said road, which significantly reduced water exchange with the Mediterranean, has created a recipe for poor water quality. The assessment team visited the outfall of Damietta’s municipal wastewater and noted anaerobic conditions characterized by black color and foul odor. In addition to Bahr el Baqar and El Sayalla, untreated sewage enters the lake through smaller drains from surrounding towns and villages.

Manzala is also a dumping ground for solid waste from Port Said and Damietta. Most of Port Said’s solid waste is dumped and burned in areas that have been drained. The solid waste problem appears to be larger in Damietta, particularly near the town of Shata, where garbage stretches for kilometers along the lake shore. Industries also contribute to the solid waste problem by disposing of dust and cement powder. Due to improper solid waste disposal, the potential is high for harmful chemicals to leach into surface and groundwater supplies.

Over the last decade, comprehensive water monitoring has been conducted twice, in 1992 and over a two-year period in 1996 and 1997. This monitoring has focused on Bahr el Baqar and its impact on pollution levels inside the lake. Significantly less water quality data exist for the 30,000-feddan basin in the northwest, which also is highly polluted.

According to a 1992 study that was part of preparation for a passive wetlands project financed by the Global Environment Facility, the outfall area of the Bahr el Baqar is contaminated with the heavy metals copper, zinc, and lead, while the entire lake has high iron and nickel concentrations. In the case of lead, levels were comparable to background levels found in the Mediterranean region.<sup>8</sup> Most of these heavy metals, however, precipitate out of the water

column into the sediment layer in Bahr el Baqar itself and in the immediate area of the outfall. Heavy metals, therefore, do not get absorbed in large concentrations by fish. Instead, heavy metals concentrations are several thousand times higher in sediment layer than in the water column. The ability of wetlands to function as efficient traps for sediment is well documented. In fact, wetlands are estimated to remove between 60 percent to 90 percent of suspended solids from influent flows. With the sediment providing an important environmental "sink" for heavy metals, it is difficult to predict how fertile these lands would be for agriculture if they were reclaimed.

The 1996/1997 study of Bahr el Baqar funded by the British Department for International Development found that Lake Manzala suffered from poor water quality around the outfall. The study found that a pollution field from Bahr el Baqar, where low dissolved oxygen levels began to harm fish and other aquatic life, stretched on average for 9.2 km from the outfall and covered an area of 19.8 km<sup>2</sup>. The study also found that the biological, chemical, and physical properties of the lake helped to restore water quality to acceptable standards for pathogens. In the Bahr el Baqar drain, pathogens concentrations exceeded acceptable standards for fishery use. Further downstream in the lake, in all but one sampling site, pathogen counts fell into compliance.<sup>9</sup>

With the spotlight shining on Bahr el Baqar in recent years, positive actions are being taken to reduce pollution. In 1985, ground broke for three wastewater treatment plants – Gabal El Asfar, Berka, and Balaks – to handle Greater Cairo's sewerage. They have gradually come on line with primary treatment. Once they become fully operationally in 2003, they will have the capacity to provide primary and secondary treatment for 2.2 million m<sup>3</sup> of wastewater daily.<sup>10</sup> However, total coverage of all major sources of sewerage from Bahr el Baqar is not foreseen until at least 2020 to 2030.<sup>11</sup> Plans for how to address large quantities of pollutants discharged from agriculture and other non-point sources have yet to be determined.

The situation for the northwest basin where the El Sayalla drain discharges Damietta's partially and untreated sewerage is less clear. It is uncertain whether any plans to upgrade the city's wastewater treatment plant. The Fishery Authority is building a new multi-million dollar inlet between the 30,000-feddan basin and the Mediterranean Sea to improve water exchange and mitigate the impact of the Port Said-Damietta road which cut the basin off from the sea and main lake.

### *Lake Maryut*

One argument used to justify reclaiming Lake Maryut is that the lake is polluted beyond the point of making restoration economically or technically feasible. Indeed, questions about just how polluted the lake is and the degree to which heavy metals and other toxic substances are present appears to be a longstanding point of controversy. Virtually no single institution conducts comprehensive water quality monitoring on a regular basis (GAFRD does basic water quality monitoring monthly), and as a result, current data to respond to the debate are hard to find. The assessment team relied on field observation, expert opinion, and findings from a 1997 USAID-funded study that conducted sampling and analysis throughout the basin as part of USAID's Alexandria Wastewater Project.

In Lake Maryut, about 1 million m<sup>3</sup> of municipal and industrial wastewater flows into the basin daily, of which approximately 60 percent is untreated.<sup>12</sup> Daily sewerage inflow accounts for 3.3 percent of the lake's total volume of 30.2 million m<sup>3</sup>. The largest source of pollution is the El Kalaa drain, which discharges 0.8 million m<sup>3</sup> of Alexandria's municipal and industrial waste each day in the 6,000-feddan basin. El Kalaa carries effluent from Alexandria's sewerage treatment plant. At the discharge site, El Kalaa's heavy organic loads creates an anaerobic plume.

In addition to municipal wastewater, Lake Maryut receives a large amount of industrial waste. In 1997, more than 130 factories located in and around Alexandria, equaling 40 percent of Egypt's national industry, discharged 240,000 m<sup>3</sup> daily into drains, the lake, and the sea.<sup>13</sup> Petrochemical refining, food, chemical, textile, ceramic, cement, butane gas, and electronics industries are among these factories. According to local environmental and fishery officials, anywhere from 40 percent to 60 percent of these industries do not treat their wastes properly and are not in compliance with Law 4. Bringing these industries up to standards is a quandary for these officials. Many of the factories are publicly owned and are unable to pay for wastewater treatment because they operate with low or even non-existent profits. Authorities tend to be lenient with these industries because they fear the financial burden of complying with Law 4 may lead to the factories' closure, which would have severe impacts on local employment. Still, others claim that these industries are essentially untouchable because they are publicly owned and operated.

The improper disposal of Alexandria's solid waste is also a major environmental threat and aesthetically an eyesore for the city. Approximately 2,770 tons of garbage are dumped around the lake each day, where it is sorted for recyclable materials and then burned.<sup>14</sup> Alexandria's main dump is located along the banks of the 1,000-feddan basin. The garbage is piled four to six meters high. El Amrya uses an 20-feddan area just west of the 3,000-feddan basin for its garbage. In addition, garbage is dumped along the El Kalaa, Abies, and Omum canals to the point where drainage water is occasionally obstructed. It is alleged that sludge from the wastewater treatment plants is disposed of near the lake and even on the banks of drainage canals. Inevitably, hazardous materials find their way into the lake and groundwater, through leaching or through the deposition of particulate matter and ash from burned waste.

According to local officials, solid waste is also used for land reclamation. Thousands of feddans have been dried by initially dumping garbage to build roads, factories, and houses. Fisherman take a more conspiratorial view and say that the garbage is used to give Lake Maryut a bad public image in an effort to gain support for drying the lake.

Compared to Lake Manzala, Maryut's pollution problem is more severe. While the overall amount of sewerage entering Lake Manzala is higher than in Lake Maryut, Maryut's smaller size makes this volume proportionately much greater. In addition, because wastewater entering Manzala from Cairo travels 190 km before its outfall to the lake, organic matter has been partially oxidized. In addition, Manzala receives proportionately more agricultural drainage than sewerage which helps dilute the waste.

In 1997, as part of an environmental study to determine future sewerage treatment plans for Alexandria, USAID funded comprehensive water quality analysis and a risk assessment in Lake Maryut. The study team analyzed water, sediments, fish and animal tissue, and then

assessed cancer and non-cancer risk. The study's overall conclusion was that wastewater discharged from Alexandria to Maryut presented acceptable and even very low chemical risk to the general public.<sup>15</sup> However, for fishing communities that eat a substantial amount of fish from the lake, the study reports, "Fishermen might use this resources as a subsistence fishery, and therefore consume enough fish from this source on a daily basis for a lifetime to make this a real risk."<sup>16</sup> In one sampling point in the northwest basin, cancer risk was considered not acceptable due to the detection of one volatile compound, probably originating from an industrial source.<sup>17</sup>

Elevated levels of certain chemicals exceeding human health criteria in the 6,000-feddan basin, location of most fishing activities. In the water column, the study identify two chemicals as potential concern (COPCs) for human health. Four substances were identified as COPCs in the sediment.<sup>18</sup> Local scientists explain that heavy metals are a relatively low threat to human health because they precipitate out into the sediments bed. The study concludes that exposure to pathogens from sewerage was of greater concern to the local population, particularly to local farmers and fishers, "Lake Maryout fishermen and their families are strongly exposed to pathogenic organisms present in human waste."

It is safe to say that Lake Maryut's role in providing passive wastewater treatment to the people of Alexandria is worth hundreds of millions of dollars. The lake essentially provides primary and secondary treatment for 1 million m<sup>3</sup>. Scientists say that although el Kalaa sewerage water enters Lake Maryut in a very poor state, water discharged from Maryut to the Mediterranean is of good quality. Maryut helps keep the Mediterranean coast clean. By further reducing the size of Lake Maryut for urban and agricultural expansion, scientists argue that the city is loosing an asset. Should Maryut be reclaimed entirely, the city will need to find an alternative way of treating its wastes or dispose of the waste directly into the Mediterranean. While there are discussions of upgrading to secondary treatment for Alexandria, financing the US\$270 million price tag has not been found to date.

Lake Maryut's current role as Alexandria's least expensive wastewater treatment facilities, however, comes at a heavy price to fisheries and the health of fishermen. Over the last few years, GARFD and fishermen have struggled with the eutrophication of the lake. Until recently, vast mats of water hyacinth and reeds covered almost the entire surface. The vegetation retarded water circulation and consolidated the sediment, contributing to natural drying and more oxygen depletion. Annual fish production plummeted from 7,700 tons in 1988 to a low of 1,900 tons in 1990, compared to the 1958 annual production of 156,000 tons.

In response, GARFD has embarked on a program to remove the vegetation. The authority has purchased dredgers that remove the plants and open up channels. Their goal is to have no more than 30 percent of the surface area under vegetative cover. Although local GARFD officials state that their current financial resources are modest compared to the need, it appears that the program is meeting with success. Fish production has risen significantly in the last few years, from a low of 1,900 tons in 1990 to a recent high of 5,240 tons in 1999. Local fishery authorities say that with additional financial resources and equipment, environmental quality and fish production could be improved further.

Perhaps the most important issue that GARFD still needs to tackle is rapid sedimentation. The heavy inflow of suspended solids and solid waste is causing the lake bed to rise each

year. Without remedial actions, the lake will naturally enter advance stages of drying. According to one respected expert, sedimentation is the greatest threat to Maryut's future. Fishermen are very concerned about this problem and plead to allow water levels to rise so that the overall volume of the lake can increase. However, increasing water levels is not possible. In order for agricultural drainage to flow into the lake according to engineering designs, Maryut's water level cannot exceed 2.8 meters below sea level. Given this reality, Lake Maryut is getting shallower and water volume is decreasing. With less water volume, pollution becomes more concentrated and fish production inevitably falls. Dredging the lake is perhaps the only short-term solution.

### **Future wastewater trends in the Delta**

According to USAID's Water Policy Reform Program, the entire Nile delta region had an estimated population of 44.6 million people in 1996 which, together with industry, discharged about 2.17 billion m<sup>3</sup> of wastewater annually. Approximately 20 percent of these discharges alone flowed through Bahr el Baqar into Lake Manzala. Given that 75 percent of all drainage water destined for the Mediterranean Sea passes through the four northern lakes, it is safe to assume that most of the delta's sewerage flows through the lakes. In the future, wastewater experts use conservative population growth rates to predict that sewerage flow will increase by at least 1.5 times in 20 years, to about 3.25 billion m<sup>3</sup> annually.<sup>19</sup> In 1998, 38 treatment plants were in operation, and another 107 were under construction or planned construction. The combined existing treatment capacity was 1.7 billion m<sup>3</sup>, with another 0.8 billion m<sup>3</sup> planned, to total about 2.5 billion m<sup>3</sup> per year in existing and future capacity. Given current projections, the best case scenario is that approximately 0.75 billion m<sup>3</sup> of sewerage will continue to be untreated.

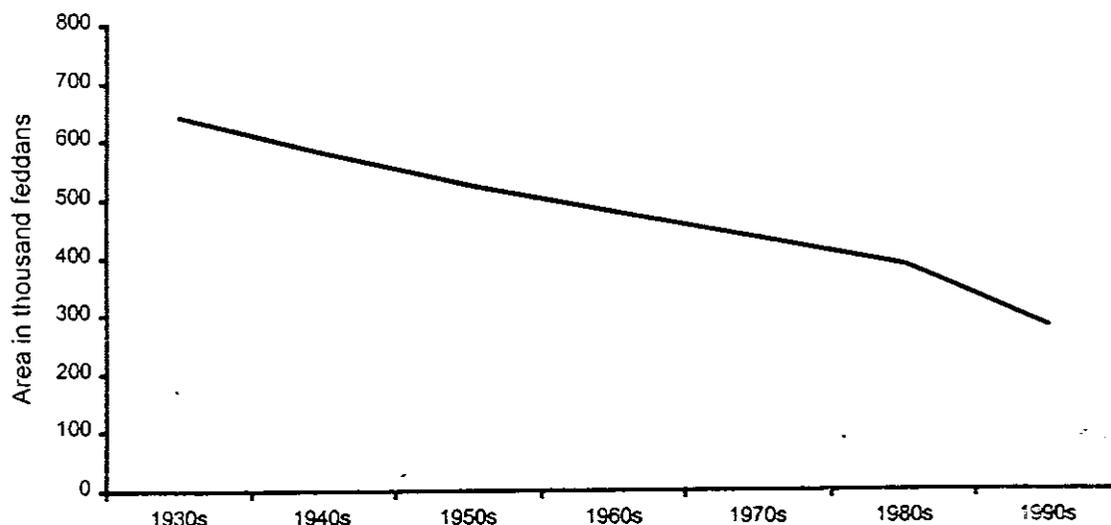
However, according to USAID's water resource project, "The sources of the required investment and the timing of construction and operation of the planned plants are still uncertain. Evidently, the future picture of the development of treatment facilities in the Delta region is not optimistic, and a broader control options, including pollution abatement at sources and separation of municipal and industrial wastewater from agricultural drains will have to be considered."<sup>20</sup> The implications of receiving more wastewater needs to be considered in future planning for the lakes.

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- <sup>1</sup> Meininger
  - <sup>2</sup> USAID Egyptian Environmental Policy Program, P. 40.
  - <sup>3</sup> USAID Egyptian Environmental Policy Program, p. 36
  - <sup>4</sup> USAID Water Policy Reform Program, p. 2-11
  - <sup>5</sup> Personal communication.
  - <sup>6</sup> USAID Egyptian Environmental Policy Program, p. 53.
  - <sup>7</sup> Government of Egypt - GAFRD
  - <sup>8</sup> UNDP, p.2-38.
  - <sup>9</sup> EA Engineering, Science and Technology, Inc, p. 100.
  - <sup>10</sup> Drainage Research Institute, Egyptian Ministry of Public Works and Water Resources, p.6.
  - <sup>11</sup> Drainage Research Institute, Egyptian Ministry of Public Works and Water Resources, p.3.
  - <sup>12</sup> Alexandria General Organization for Sanitary Drainage.
  - <sup>13</sup> M.Kammoun
  - <sup>14</sup> EA Engineering, Science and Technology, Inc, p. 100
  - <sup>15</sup> EA Engineering, Science and Technology, Inc, p. 100.
  - <sup>16</sup> EA Engineering, Science and Technology, Inc, p. 100.
  - <sup>17</sup> EA Engineering, Science and Technology, Inc, p. 90
  - <sup>18</sup> EA Engineering, Science and Technology, Inc, p. 46
  - <sup>19</sup> USAID Water Policy Reform Program, p. 3-3
  - <sup>20</sup> USAID Water Policy Reform Program, p. 3-5

### 3. Land reclamation

Since the 1930s, 56 percent of the northern lakes surface area has been reclaimed for agriculture, urban and industrial development, canals, and roads. The lakes have decreased from 641,000 feddans in the 1930s to less than 280,000 feddans in 1997.<sup>1</sup> Most of the reclamation has been part of a nationwide program to increase the amount of arable land available to meet the food and employment needs of the growing population. Egypt has set for itself a goal of expanding land under agricultural and urban development from the current 5 percent to 25 percent of the country's area. Of the four northern lakes, Manzala and Maryut have been the most affected by this policy. Because land reclamation occurs continually through smaller scale initiatives, calculating the current surface area of the lakes or obtaining an updated map is very difficult.

Graph 1  
Northern Lakes Surface Area, 1930s to 1990



The impacts of this large reduction and loss of habitat to fish and wildlife have been dramatic. According to one analysis conducted by the team, an estimated 31,400 tons of fish are foregone each year in Lake Manzala, valued some LE 236 million. For Maryut, about LE 157 million are foregone.<sup>2</sup> As the lakes have contracted and production numbers have fallen, fishermen have been forced into a smaller area. On a per unit basis, fishing effort has increased and so has competition, leading to the overfishing and illegal fishing common throughout the lakes today. The combination of reduced habitat and water pollution also has impacted the number of migratory birds visiting the lakes. Lake Maryut once was a major area for wintering waterfowl. An estimated 45,000 birds were shot or caught there each year in the 1920s.<sup>3</sup> By 1990, however, only 10,085 birds and raptors were counted in total. Furthermore, significantly fewer migratory birds now visit Lake Manzala.

Fishermen are particularly concerned about the land reclamation issue. They believe that all other threats are dwarfed by the risks associated with drying. Some fishermen go as far as to predict that the lakes will be totally dry in the future and problems of pollution, eutrophication, or sedimentation will be inconsequential in comparison. To a certain extent, the fishermen are right. Should historical rates of reclamation continue unabated, Lakes Maryut and Manzala risk being completely dried in the next 20 to 30 years. Future reclamation may be driven by several factors. The lakes have fertile alluvial soils that are good for agriculture. Their shallow depths makes pumping water to drain the land relatively inexpensive. Moreover, they are located in areas that have large and expanding populations that need the space to grow. Future pressures for land may indeed lead to more widespread reclamation unless concrete and unequivocal steps are taken soon to stop this trend.

### **Institutional Background**

Reclamation of the northern lakes has been a longstanding point of contention between several ministries, governorates, the private sector, and fishermen. The case of land reclamation for agriculture illustrates how basic policy affecting the lakes has been poorly coordinated among government institutions. Responsibility for land reclamation rests with the General Authority for Rehabilitation Projects and Agricultural Developments and the Ministry of Water Resources and Irrigation. Although GARPAD and GARFD are both housed in the Ministry of Agriculture, the two authorities do not interact with each other. As a result, GARFD has not participated in decision about where land reclamation would occur around the lakes. Construction of the various roads that pass directly through Lakes Manzala and Maryut has followed a similarly sectorally oriented pattern of decision making.

Virtually all current land reclamation programs out of GARPAD in the northern lakes were planned more than 10 years ago. At that time, the basic criteria for siting new projects were the depth of water required to be pumped and soil fertility. The northern lakes, with their shallow depths and fertile soils, were considered highly desirable from a land reclamation perspective at the time. They were considered to be significantly less expensive to reclaim than the open desert. Under the old system, economics and environmental and social impacts were not incorporated into the analysis.

Under Law 4, GARPAD currently uses a broader set of criteria for siting future reclamation schemes. The authority now incorporates environmental impact assessments as part of their work to identify new sites. In the upcoming 2002 - 2017 National Development Plan, which is still being drafted, GARPAD's objective is to reduce the rate of population growth in the Nile valley and delta. In addition, all new reclamation projects are located in unpopulated desert areas in the south of the country and on the Mediterranean coastal fringes. No new reclamation projects for agriculture are currently planned by GARPAD in any of the lakes, although current reclamation projects will go forth to completion. One important limiting factor to future land reclamation throughout Egypt is the shortage of water.

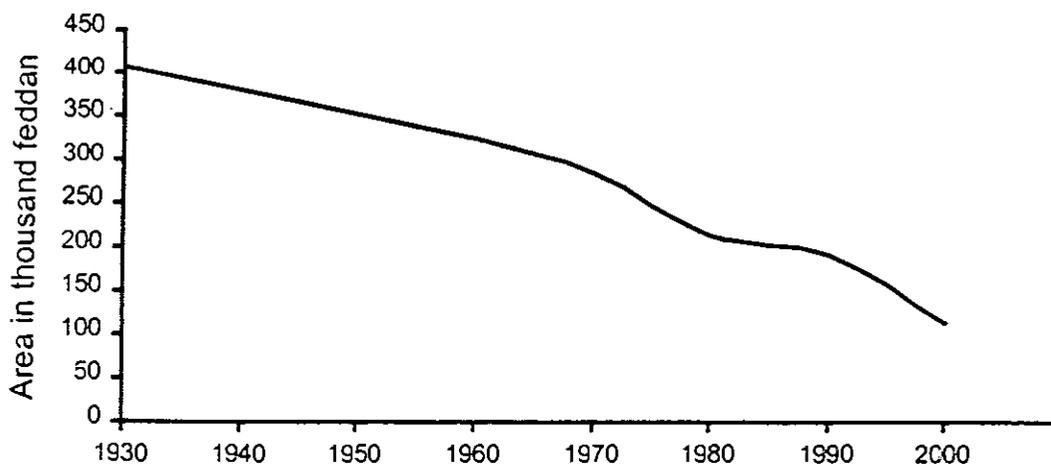
GARPAD's new and more integrated approach for selecting future reclamation sites is a welcomed step for protecting the lakes. However, the final decision depends as much on political considerations as on technical ones. Strong political interest continue to be exerted to drain Lakes Maryut, Idku, and Manzala for urban development, agriculture, and private fish farming. Thus, it is still uncertain at this point whether any new reclamation sites will be approved in the 2002 - 2017 National Development Plan. Even if no new land is reclaimed in the immediate vicinity of the lakes, the northern delta region may still be negatively affected by the push for new land reclamation. Freshwater currently entering the lakes will be diverted for irrigation to newly reclaimed areas.

### Land Reclamation in Lake Manzala

Despite Manzala's status as the largest and most productive fishery of the four lakes, the wetland is just a fraction of its original size. Measuring 407,000 feddans in the 1930s, the lake now covers about 130,000 feddans, a 68 percent loss over the past 70 years. It is commonly believed that the wetland was as large as 750,000 feddans at the turn of the century. Manzala has been reclaimed for agriculture, roads, industry, and housing. Under current GARPAD plans, Manzala will be reduced further to 114,000 feddans by 2001.

Most of the recent reclamation work has occurred under the North Sinai Integrated Development project. Approximately 80 percent of the 220,000 feddans scheduled for reclamation under this project has already been drained.<sup>4</sup> Current land reclamation is being carried out in the El Gohr region in the southeast sector. Once land reclamation has been completed, about 20 percent, or 7,000 feddans of El Gohr's original 33,000 feddans will remain under water. The basis for the North Sinai project permitting the reclamation of Lake Manzala is a decree from the Ministry of Agriculture issued in the late 1980s.

Graph 2.  
Area of Lake Manzala, 1930 to 200



Other reclamation projects are in the works. The city of Port Said is planning to reclaim about 3,000 feddans for housing. Another 10,000 feddans are scheduled to be reclaimed for the new Pan-Arab highway, which is currently under construction and will connect all the countries lying between Morocco and Turkey. In Lake Manzala, the highway will transect the top third of the lake, cutting it off from the bottom two-thirds. Culverts are planned for some degree of water exchange between the newly created basins, although fishermen say that they will no longer be able to pass to the other side of the lake and that water circulation will be impaired. Fishermen also express concern that the new international road will bring new forms of development to the region and will place additional demands for land. Other highways, such as the Port Said-Damietta road and the ring road just outside of Port Said, have also been built to transect the lake. These roads act as barriers to the movement of water, fish, and fishermen. Although culverts connect the different basins with the main lake body, the smaller basins are considered to function more or less independently.

In addition to these publicly sponsored reclamation projects, about 20 percent of land reclamation is driven by the private sector, mostly for fish farming, housing, and industrial expansion. The desire to reclaim new land has allegedly reached inside the lake. Members of an agricultural cooperative from farms located on the various islands in the lake have expressed interest in draining new areas to expand their plots.

Anecdotal evidence suggests that these land reclamation projects have not always achieved their intended objectives and returns. For example, the area reclaimed in the South Port Said Plain Zone which lies between Ismailiya and Port Said has remained unused since it was reclaimed in the 1980s. A land tenure dispute broke out between the fishing community that used to live in the area and the new occupants, graduates and former GARPAD staff which received access to the land in exchange for leaving the public sector. According to local GARFD staff, other parts of this tract are still waiting for irrigation sub-canals to be constructed. In the South Husseniya valley, formerly reclaimed lands have been converted to fish farming. Farmers found the alkaline soils and the upward flow of saline ground water to be incompatible with agriculture.

Although fishermen displaced by the reclamation project are scheduled to receive land under the North Sinai project as compensation, they are very disgruntled. They have been very reluctant to accept the land as they have little interest or skill in farming, and strongly prefer to stay with their traditional profession.

The El Salam canal, which is the North Sinai project's main irrigation artery, has also raised some concerns regarding its impacts on fisheries and the environment. Because the canal cuts off the southern third of Lake Manzala through Sharkiya and Port Said governorates, the newly created lower basin has undergone physical, biological, and socio-economic change.

Throughout Manzala's long history of drying, members of the fishing community report that they have lacked the authority and opportunity to participate in determining the nature or location

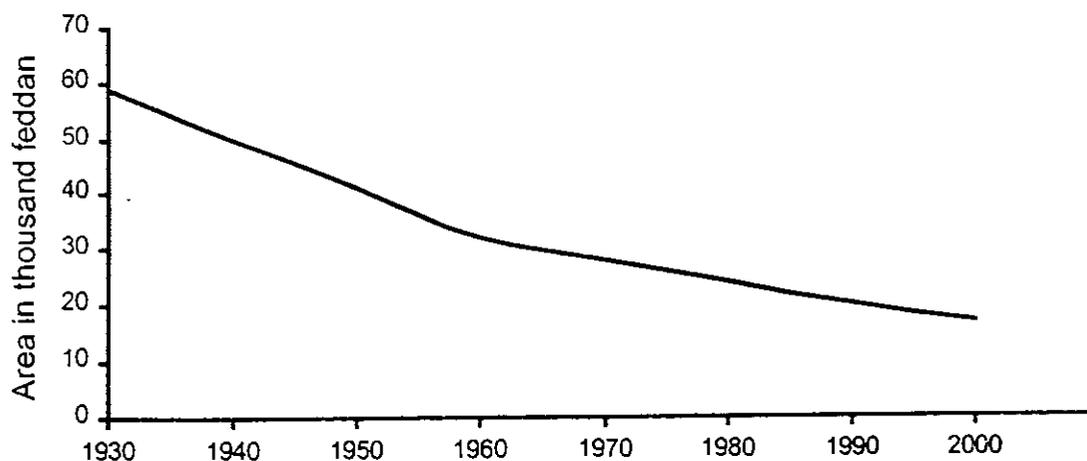
of new development projects. As a result, they are highly critical of large development schemes. They question why the new international road was sited in a way that cuts the lake into two large basins rather than locating the highway next to the current road which connects Damietta and Port Said. This second approach would have avoided the need to create another new basin.

### Land Reclamation in Lake Maryut

Like Manzala, Lake Maryut also has been subjected to a long series of land reclamation projects over the years that cumulatively have had a dramatic impact on the lake. Over the last 65 years, the smallest of the northern lakes has lost approximately 71 percent of its area, decreasing from 59,000 feddans in 1935 to between 15,000 to 17,000 feddans today. (Due to the lack of a current map and continual reclamation, it is difficult to determine the current surface area of Maryut, as is the case in Manzala). Most recently, the so-called 6,000-feddan basin, which fishermen regard as the most productive, was reduced to approximately 4,000 feddans.

From the 1940s to 1960s, land reclamation was mostly conducted for agriculture. In addition, a series of roads and drainage and navigation canals were constructed that effectively cut Lake Maryut into five individual basins that are named after their former surface areas: 6,000 feddans (the main basin), 5,000 feddans, 3,000 feddans, 2,000 feddans, and 1,000 feddans. Roads and canals have blocked the movement of water, fish and fishermen, and make each basin function independently. As a result, each basin has unique characteristics that requires specifically tailored management activities. In the early 1980s, about 1,400 feddans were dried for several projects that included the sewerage facility, electricity plant, and an international park. Since then, other parts of the lake have been filled in with garbage.

Graph 3.  
Area of Lake Maryut, 1930s to 2000



Today the pressure to reclaim the lake comes from urban development. Maryut is located just minutes away from the heart of downtown Alexandria, which has experienced rapid growth in

recent years. With the price of land increasing in the city, real estate developers have set their sights on the wetland as one of the last large open spaces available for future urban expansion. They estimate that the land is worth billions of Egyptian pounds. Even within GARPAD, periodic proposals arise to reclaim a 30,000 feddan area that would include Maryut. With strong financial and political pressure to convert the lake for agriculture and urban development, Lake Maryut could disappear in the next decades. The impacts of drying up the entire lake outside of the loss to fishing – including removal of an important drainage area for wastewater treatment, the removal of a buffer for Alexandria between the city and desert, salt-water intrusion of groundwater resources, and a buffer for flood waters – have yet to be fully understood or accounted for in economic valuations.

To counter this threat, an informal coalition of public and private groups made up of fishermen, scientists, and environmentalists have periodically rallied together to hold conferences and public meetings advocating for the lake. Fishermen have even called strikes to protest. These grassroots efforts have apparently met with some success. Recent plans to reclaim the entire 6,000-feddan basin were called off after the strike - Only 2,000 feddans were reclaimed.

In general, advocates for protecting the lake claim that a great deal of misunderstanding exists about the condition of the wetland and its ability to be restored. They contend that the public has been misled to believe that the lake is too polluted to be saved, but the reality is that restoration of Maryut's ecosystem and fisheries are promising under the right conditions.

#### **4. Fisheries Management**

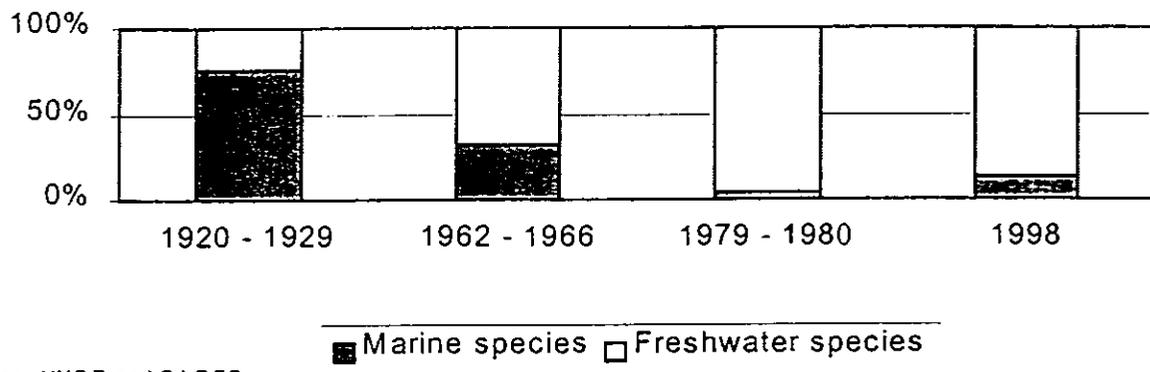
Within the Ministry of Agriculture and Land Reclamation, GAFRD is responsible for managing Egypt's fisheries resources. GAFRD was established in 1983 to develop and apply fisheries laws in all inland and coastal waters. With this mandate, GAFRD issues decrees that lay out the kinds of fishing gear and techniques allowed in the lakes. In each lake, GAFRD has established a local development committee that is made up of local government authorities from different ministries and sectors, including the environment, water and irrigation. The committees usually meet monthly to discuss a variety of management issues. They report any issues requiring further action to the chairman of GAFRD. The chair can issue a decree to address a particular problem, or report the problem to the GAFRD council or even to the minister of agriculture if another ministry is concerned. The Environment and Water Police is in charge of supervising the application of fisheries and environmental laws in the lakes.

In practice, GAFRD has a low profile inside the Ministry of Agriculture. Part of the problem according to GAFRD personnel is that fisheries are an undervalued resource in Egypt. They claim that Egypt has always – since the days of the pharaohs – placed more importance on agricultural development than on fisheries. Ironically, this policy may be self-fulfilling. As habitat for fish has deteriorated, fish catch and values have suffered.

## Fish Production in the Northern Lakes

The northern lakes contain a mixture of marine, brackish, and freshwater fish. The proportion of these three groups have changed significantly over the last 50 years. Salinity concentrations have decreased significantly as various development projects changed the lakes' hydrology. At the beginning of the 20th century, most fish were reported to be of marine or brackish origin. But late 1950s, this composition changed. The majority of the fish were freshwater, mostly tilapia, although marine fish were still caught in large amounts. By 1998, the numbers changed significantly. About 73 percent of the catch was of freshwater species. Fish and crustaceans of marine origin were not more than 14 percent of the catch.<sup>5</sup> The result of this change has also

Graph 4.  
Species Composition of Lake Manzala Fishery,  
1920 - 1998



Source: UNDP and GARFD

meant that the fishery shifted from high-value marine and estuarine species to low-value freshwater species. Graph 4 illustrates this trend in Lake Manzala.

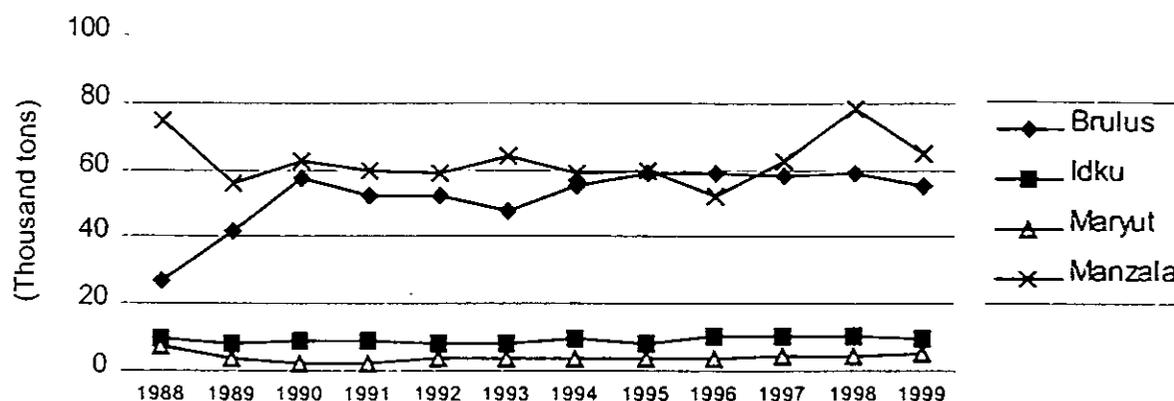
Although fish catch are significantly lower now than previously, over the last 10 years catch numbers have generally remained stable, particularly for Manzala, Burullus, and Idku. This relative stability is due to several factors. Agricultural drainage water entering the lakes has become more nutrient-rich as reclamation programs convert more upstream areas to agriculture. At the same time, the use of pesticides and herbicides is declining. As lake waters become less saline, conditions for tilapia, which now dominates the lakes, have grown increasingly favorable. For Maryut, which experienced dramatic declines in fish production just a few years ago, reaching a low of 1,900 tons in 1990, the numbers are on an upswing. Following GAFRD programs to remove reeds and open new channels up for the lake, 1999 fish production figures for Maryut is over 5,000 tons.

According to fishery experts, this stability maybe deceiving. It is believed that all the lakes fish are being overharvested. The average size of an individual fish is declining. Given current

environmental conditions, fisheries experts believe that these production figures are not sustainable over the long term.

Two types of fishing practices are common in the lakes:

**Graph 5**  
**Fish Production in the Northern Lakes,**  
**1988 - 1999**



*Capture fishing in open waters.* Under this approach, the lake is considered a common property resource and only licensed fishers are permitted to fish. The vast majority of these fishermen work at a subsistence level and are poor. Fishing is regulated by a complex set of customary rights and social conventions. The sharing of lake waters between fishing “tribes” and families, for example, is regulated by certain rights and conventions.

*Aquaculture using privately enclosed waters.* Parts of the lake have been privatized as some fishermen and investors take control over the lake shore to construct private fish farms. These farms typically are capital intensive operations that are more lucrative than capture fishing. Owners of fish farms are financially better off than their counterparts engaged in capture fishing.

Legal fishing practices are set forth in Law 124/1983 as well as in several ministerial decrees. Despite these laws and decrees, it is common knowledge that illegal fishing is widespread and numerous in form. Illegal activities include catching fish fry and fingerlings to populate private fish farms, harvesting baby shrimp for chicken feed, using illegal nets that take out juvenile as well as mature fish, and enclosing circular net boundaries commonly known as *hosha* fishing. There are periodic reports of the use of cyanide. In reality, these illegal practices reflect fishermen’s adaptive behavior in light of the lakes’ shrinking resources.

Several obstacles exist to managing fisheries in the northern lakes. GAFRD and the police report that that monitoring lake activity is very difficult, and controlling fishing effort by

traditional means has been largely unsuccessful. The lakes are located near heavily populated cities and towns where access is open. In addition, communities reportedly have little awareness of the importance of limiting fishing effort. They commonly believe that fishing is a traditional right that should remain unrestricted. These factors make controlling effort within maximum allowable limits nearly impossible. As one consequence, there are many unlicensed fishermen.

Because the fishing community is resistant to controlling access, gathering accurate figures on the number of fishermen on the lakes is very difficult. According to GARFD, a total of 22,520 fishermen were licensed and approximately 62,500 were unlicensed on all four lakes. For every licensed fisherman, an estimated three unlicensed fishermen used the lakes. GARFD estimates the total number of licensed boats on Lake Manzala to be about 18,000, although the actual number of vessels may be three to four times more. According to the Fishery Union, Lake Manzala has 4,837 registered boats in operation. Given that five fishermen usually work on one boat, an estimated 24,000 people work as subsistence fishers on Lake Manzala, supporting a total of 144,000 family members. When unlicensed boats are included, this number climbs to 40,000 fishermen. Supporting industries are estimated to employ about 250,000 to 300,000 people who build boats, weave nets, process and package fish, produce ice, and process reeds.

Similar difficulties exist with estimating the number of fishing boats and fishermen in Lake Maryut. For example, GARFD estimates that approximately 5,000 fishermen are licensed and at least twice that number are unlicensed. Given that fishing families average about six people, an estimated 90,000 people depend on Lake Maryut for their livelihoods. This number contrasts sharply with Fishery Union estimates, which calculates there are 974 licensed and approximately 6,000 unlicensed fishermen.

Another obstacle to enforcing the law is that the Environment and Water Police are reluctant to place additional burdens on the already impoverished and disenfranchised community. In instances when the police do pursue a violator, the local courts are reported to be slow and unresponsive. In some cases, the police report that local prosecutors either do not believe that the crime is important or they are unfamiliar with how to prosecute such cases. In other circumstances, the police are underequipped compared to the violators, who are sometimes likened to the mafia. The police says that they do not have boats that are fast enough to outpace violators. In other cases, the police lack boats that can go into shallow water.

## **5. Socio-Economic Impacts of Reduced Fish Production**

Fish production in Lakes Manzala and Maryut have undergone dramatic reductions over the last five decades that have led to overfishing, resource use conflicts, and security threats between fishermen. The decline has also led to a precipitous fall of fishermen's income and, accordingly, to their living standards. With low educational levels and few alternative sources of income available, the fishermen have either immigrated out of Egypt to find jobs, become unemployed, or continue to fish with earnings as low as LE 14 a day.

## Background on Fishing Communities

### *Lake Maryut*

Most of Maryut's fishing communities are located in the greater Alexandria metropolitan area. Traditionally, the lake has been the source of income for Bedouin and Delta fishermen. Bedouin fishermen live outside the city, predominantly on the western shore of the lake. They rely on fishing as their main source of income, although they may have access to agricultural land or livestock to supplement their earnings. In contrast, Delta fishermen live in the city or in illegal squatter settlements just outside the city.

Most fishing communities are considered to be among the poorest in Alexandria. Fishermen living in illegal settlements are subject to life in a shantytown: garbage, stagnant sewerage water, and congestion. Socio-economic, health, and other demographic data in western and south-western Alexandria where many fishing communities are located, consistently show a lower standard of living than in other parts of the city.<sup>6</sup> In the community of Maawa al-Sayadeen, for instance, 36 percent of the 1,236 homes in 1995 were surrounded by open sewerage. A little over half of the homes had septic tanks, but high ground water and blocked sewerage lines prevented efficient disposal. The sewerage that did enter sanitary drains discharged directly into Lake Maryut. The community lacked garbage disposal, and as a result, most refuse was dumped directly outside each house. Sixty percent of the homes did not have access to potable water.<sup>7</sup>

Health and education statistics indicate that fishing communities suffer ailments typically found in poor areas. High child mortality is predominantly due to preventable afflictions such as complications from childbirth, gastroenteritis, tetanus, and respiratory tract infection. In addition, children suffer high levels of diarrhea, respiratory disease, and parasitic infection. Severe under-nutrition has been detected approximately 15 percent of children. Of the 6,792 people living in the community, illiteracy is high (43 percent male, 58 percent females). On the positive side of the equation, most boys get at least a primary school education. About half of them grow up to be fishermen and the other half enters the public sector. More than 90 percent of older women in the fishing community are illiterate. This figure is decreasing rapidly as more girls receive at least a primary school education.

### **Impacts of Declining Fish Production**

According to a 1998 study by the Centre for Environment and Development for the Arab Region and Europe (CEDARE), "The degradation of the lake subjected the fishermen to a large decline in income, and hence to a harsh process of impoverishment." This view is shared by all fishermen interviewed by the assessment team. Fishermen are quick to describe the deterioration of Lake Maryut and its impacts in terms of lower fish quantity and quality, and altered fish species composition. They claim that in the 1970s, a day-long excursion could yield as much as 500 kilograms. Today, a similar trip produces 2 to 10 kilograms. In addition, the

fishery has changed dramatically from containing high-value and diversified marine and brackish species to one that contains five mostly low-value freshwater species.

Reduced catch has affected fishing practices. In the past, no fishing was permitted from late April to early June in order to allow the fish to replenish. Now fishing continues throughout the entire year. Furthermore, Alexandria was until recently an exporter of fish. The city currently imports fish from other lakes in large quantities.

Among the fishermen interviewed, a consensus exists that the principal threats to the lakes are industrial pollution, land reclamation, and low water levels. They note that industrial pollution has decreased in the past five years as some factories have adopted better environmental practices. However, they also voice frustration in the belief that the industries that continue to pollute have had enough time to comply with the law. Particular point sources of pollution identified by fishermen as priorities are the petrochemical companies, which have begun to treat their industrial waste. Although, several times a year these companies clean their systems by flushing and this causes fishkills. Other fishermen complain about the sulfur transfer station, dyeing and textile plants, and thermal pollution.

Fishermen believe that pollution has not impacted their health or the health of their families. Yet, illegal fishing practices, which the vast majority of fishermen engage in, requires that fishermen walk in the lake to install illegal netting. As a result, an estimated 20 percent of older fishermen have contracted belharzia. Some fishermen mentioned diarrhea, stomach pain, and skin irritation results from of their contact with the lake.

Fishermen also report that they do not eat fish from certain basins. On several occasions, livestock and poultry reared near the lake have been poisoned. Fishermen explained that not only do their diets depend on fish, but so do the diets of many other segments of society, especially the poor. While fishing communities may eat fish up to three times a day, they will eat red meat approximately two to three times a month.

Because fishing is a traditional way of life, fishermen do not believe they have many opportunities to engage in other economic activities. They even claim that sea fishing is an unfamiliar activity. Efforts to encourage fishermen to assume other sources of income have failed in the past. Because of low educational achievement and the lack of other skills, the fishermen have had a hard time finding alternative income sources. As the CEDARE study states,

"In spite of the fact that the fishermen were each offered plots of the reclaimed areas (five feddans), a house, and livestock as a compensation for the areas taken from the lake, very few of them accepted the offer."<sup>8</sup>

## Lake Manzala

Problems facing Lake Manzala fishermen and their families depend on which part of the lake they are located. Though the issues may be similar, their relative importance varies depending on the location. In Port Said, the major concerns are drying for urban development, road construction, industrial pollution, and oxygen depletion resulting from sewerage disposal. In Matariya, pollution from sewerage and private fish farming are the leading problems. There are also concerns about future water supply and quality once the El Salaam canal and its associated sub-canals are fully operational. In Damietta, pollution from the untreated wastewater and poor water circulation are at the top of the agenda.

Of the communities that border Lake Manzala, Matariya is the most dependant on fishing. Like Lake Maryut, fishermen are either of Bedouin or Nile delta origin. It is not clear how many fishermen and their families depend on the lake nor how many people work in fish related industries. Because Lake Manzala is located in three governorates and is not considered an entity of its own, a complete socio-economic picture of the lake is difficult to compose.

Lake Manzala has experienced rapid resource-use changes over the past few decades. Land reclamation by the government and by private investors which take possession of the land through wadi yed has led to the rapid growth of private fish farming. This issue has apparently two impacts on the community. First, land reclamation has reduced the amount of common area available to subsistence fishermen and affected productivity of fish cooperatives. For example, one large fish cooperative near Port Said lost access to a 1,000-feddan fish farm which it had worked for years. About 900 feddans were reclaimed for the Mubarak Graduate Program, and another 100 feddans were allocated for a nursery to supply stock for private fish farms. To date, the reclaimed land has yet to achieve its intended use. Part of the reclaimed land is currently being used for livestock production. Other areas are still vacant or have been taken over for smaller fish farms. The intended beneficiaries, the graduates, have still not received the land.

Several people claim that the growing number of private fish farms may actually be saving parts of the lake from being reclaimed. Fish farms provide their owners with title to land that otherwise would be considered public and available for reclamation. The current governor of Port Said is encouraging private fish farming. Nonetheless, the sharp reduction of the common area available for subsistence fishing is further impoverishing the fishing community. In addition, fishermen report that water salinity is increasing and also contributing to falling production numbers. They believe that one way to resolve the issue is to increase the quantity of freshwater to the lake.

In Port Said, fishermen cope with the loss of fishing income by supplementing their income with the trade of legal or illegal duty-free goods. Other fishermen have fewer options. According to Matariya officials, the economic hardship caused by the loss of income from fishing has caused men to migrate out of the area. About 20 percent of the town's young men seek employment outside of Egypt, while about another 25 percent are unemployed. Towns such as Al-Borg, where about 10,000 fishermen work and many people are involved in boat manufacturing, have suffered

tremendously from the downturn.

In Matariya, fishermen complain of skin disease and irritation, kidney and liver failure, and belharzia. An early study showed fishermen and their families have worm infestations, salmonella, shigella and viral hepatitis (MacLaren, 1980). These fishermen rely heavily on their fish catch for their daily food. In Matariya, one fisherman explained that his family eats fish three times a day, six times a week. The heavy consumption of fish from heavily polluted areas of Manzala may be putting these communities at higher exposure rates to harmful substances.

Lake Manzala police express concern over the future of the lake. The shrinking fishery is driving more fishermen to adopt illegal fishing practices. Recently, violent skirmishes broke out between armed fishermen belonging to different tribes or "mafias" vying for control over different parts of the lake. These skirmishes have kept the water police on alert, especially for illegally caught fries and fingerlings used to supply private fish farms.

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<sup>1</sup> Government of Egypt - GAFRD.

<sup>2</sup> From the 1930s until today, Lake Manzala has decreased by about 277,000 feddans. Based on the assumption that the average catch per feddan in these earlier years was about 113.6 kg, the total loss to fish production due only to land reclamation is about 31.4 million kg, or about 31,400 tons per year. This amounts to about LE 236 million every year in 1999 prices. Following the same methodology for Lake Maryut, which saw 42,000 feddans reclaimed and had an average catch of approximately 500 kg per feddans, the yearly losses in fish production is about LE 157 million.

<sup>3</sup> Meinertzhagen, R.

<sup>4</sup> Sectors for land reclamation in Lake Manzala: South Port Said (45,000 feddans); North-South Port Said (47,000 feddans); Lake Um El Rish (2,100 feddans); South Hussenya Valley (57,000 feddans); North Husseniya Valley (20,000 feddans); Mataria El Salam (8,000 feddans); and El Atwy (3,500 feddans).

<sup>5</sup> Government of Egypt - GAFRD

<sup>6</sup> EA Engineering, Science and Technology, 1997.

<sup>7</sup> High Institute of Public Health and UNICEF (1995)

<sup>8</sup> El-Karanshawy, p. 8.

## Section IV

### Recommendations

Current threats to the northern lakes may well lead to a significant downturn in fish production in the short term and to the lakes' ecological collapse within two to three decades unless remedial steps are taken. It is unfortunate that poor institutional coordination, the undervaluing of the lakes' resources and environmental services, and other factors have created the current management conflicts. Fortunately, steps can be taken to reverse this trend. With consensus among key decision makers and stakeholders, along with concerted effort, the northern lakes have the ability to provide an array of vital environmental services and economic benefits for years to come.

The impact of staying on the current course may be high. Should the lakes be eliminated or further degraded, significant social, environmental, and economic costs will be incurred:

- As many as 2.7 million fishermen, support service workers, and their families could be further impoverished and displaced.
- One of the country's most important protein sources for its low-income citizens would be lost, potentially impacting their nutritional status.
- Large amounts of sewerage may be directly discharged into the Mediterranean or shipped at significant expense to the desert for disposal.
- Salt water intrusion of groundwater supplies may follow and potentially accelerate soil salinization of the northern delta.
- Vulnerability to flood damage from coastal storms may increase for areas with major investments.
- Vital habitat for wildlife, including migratory birds of the Mediterranean and Europe, will diminish.

To reverse the current trends, measures need to be taken with a short- and medium-term perspective. This section presents a series of recommendations that can serve as a starting point for decision makers and stakeholders to develop a strategy and activities to improve the environment and fish production in the short run, while also building essential institutional structures and enabling conditions over the long term for sustainable development.

The major thrust of the team's recommendation is that integrated coastal zone management (ICZM) needs to be seriously considered as a new management approach to improve fisheries and environmental quality, while also meeting other sectoral demands in the northern lakes. ICZM has been embraced by countries around the world that have confronted similar conflicts. The goal of ICZM is to achieve sustainable development. ICZM relies on analyzing the implications of development, conflicting uses, and relationships between environmental, economic, and social processes. Ultimately, ICZM aims to promote linkages and harmonization

between the different sectoral activities and goals. In practical terms, ICZM addresses several important functions identified in Table 6.

**Table 6. Major Functions of Integrated Coastal Zone Management**

Area planning	Plan for present and future uses of coastal areas to provide a long and short-term vision
Promotion of economic development	Promote the appropriate uses of coastal and water resources.
Stewardship of natural resources	Protect the ecological base of coastal, estuarine, and riverine environments, conserve biological diversity, and ensure the sustainable use of these resources.
Conflict resolution	Harmonize and balance existing and potential uses; address conflicts among coastal and terrestrial uses.
Protection of public safety	Protect public safety in coastal areas typically prone to natural and man-made hazards
Proprietorship of public submerged lands and waters	As governments are often outright owners of specific coastal areas, a public obligation exist to manage resources wisely and with economic returns for the common good.

Source: Cicin-Sain and Knecht, p. 47.

### **Recommendations to Promote Integrated Coastal Zone Management**

Promoting ICZM in the northern lakes inevitably requires a long-term perspective. The origins of the problems witnessed today go as far back as 70 years and even beyond. Reversing these trends and finding solutions will require time. To begin, the assessment team recommends a two-phased approach to pursue short-term actions over the next two years, and then medium-term actions beyond the two years. The goal of these short-term actions need to be mitigating current high-priority problems and reducing the risk of impending threats. Over the medium term, the goal needs to be adopting and institutionalizing an integrated management approach that encourages the lakes' restoration and their sustainable development to meet the needs of multiple stakeholders.

#### ***Illustrative Results Framework***

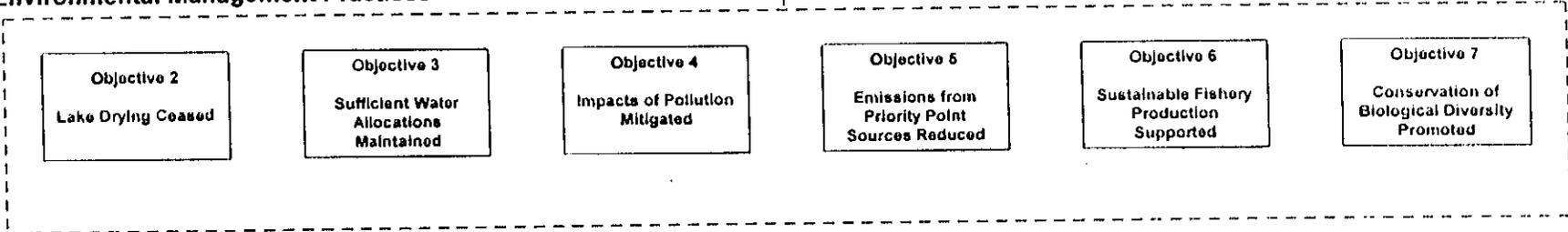
To help organize short-term efforts, the team has drafted a result framework that captures within a conceptual construct the key objectives that need to be pursued over the next two years. The results framework in Figure 6 is based on a hierarchy of results and "impact

**Illustrative Results Framework**

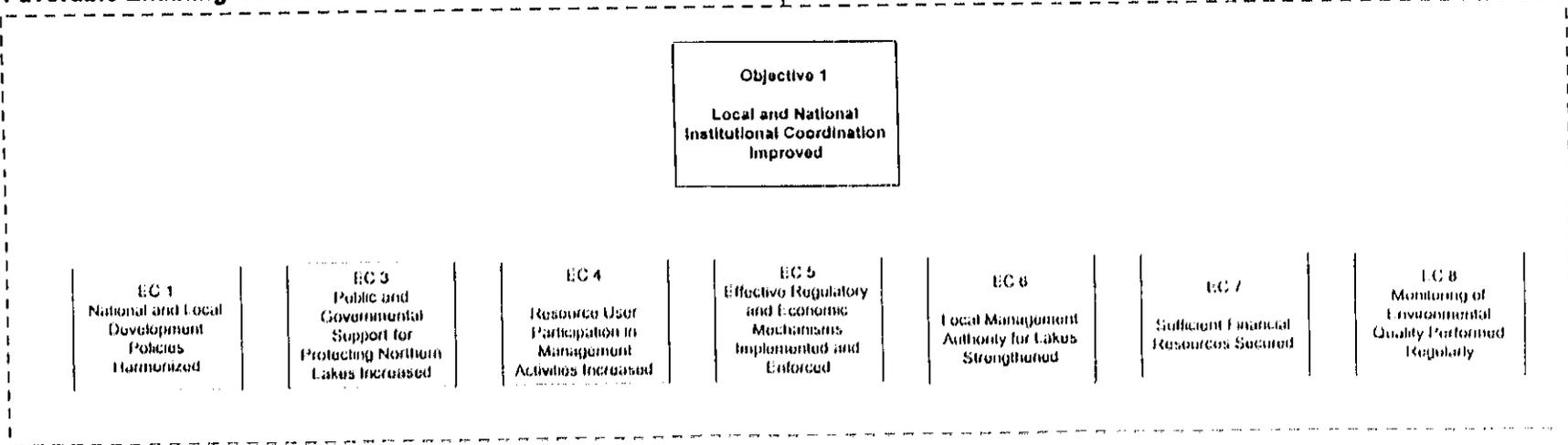
**Impact Level I - Biophysical and Socioeconomic Improvements**

Two-Year Goal  
**Increased Fish Production through Improved Environmental Quality in the Northern Lakes**

**Impact Level II - Adoption of Improved Environmental Management Practices**



**Impact Level III - Establishment of Favorable Enabling Conditions**



levels". The foundation of the framework is supported by mutually supportive "enabling conditions (ECs)". These enabling conditions depict the results that need to be pursued concurrently at the national, governorate, and local levels to build a favorable policy and institutional setting for fisheries and the environment (impact level III).

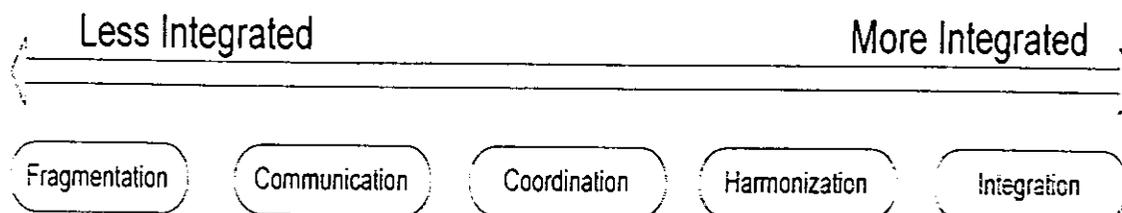
Under this hierarchy, the assumption is that once the correct enabling conditions are established, the expected result will be that resource users will adopt improved environmental management practices (impact level II). These practices may include industries installing cleaner technologies to reduce pollution, or ministries and governorates no longer drying the lake, or fishermen practicing sound harvesting approaches.

As resource users improve their management practices, the impact should be that key environmental threats are decreased: industrial pollution will decline, destructive fishing will diminish, and land reclamation will cease. The culmination of improved natural resource management practices and reduced environmental threats should be that fishery production and environmental quality are improved (impact level I). This improvement will mean that better water quality will lead to increased fish production. In short, the basic integrity and equilibrium of the northern lake ecosystem will be revived for sustainable development.

To put this strategy into action, activities must be specially tailored to support each objective. Below are recommended activities that can be pursued through an integrated approach that involves all the relevant ministries, NGOs, international donors, etc. While there are seven objectives identified in this strategy, determining which recommendations to pursue should be discussed with the appropriate ministries and stakeholder groups to gain consensus on the priorities.

## OBJECTIVE 1 – IMPROVE INSTITUTIONAL COORDINATION

The complex overlay of issues and institutions confronting the northern lakes makes it impossible for a single ministry to meet all the challenges in the lakes. A critically important aspect of implementing this strategy must be to achieve better institutional coordination between the different ministries, government units, and stakeholders. This finding was discussed extensively during the Port Said workshop and emerged as a major recommendation. Coordination must encompass horizontal integration among the various sectoral interests, and vertical integration between the different levels of government and stakeholders. The goal needs to be to move away from the current situation where government sectors and stakeholders do not interact with each other to a situation where a forum is available for discussing, coordinating, and harmonizing existing and future policies.



Coordination can be seen as a continuum. As a first step, an opportunity needs to be made available for each ministry and stakeholder group to communicate with each other about their own goals and objectives. To date, there has been very little communication of this nature.

Areas of mutual interest need to be identified, and where appropriate, for example in the areas of reducing industrial pollution and sewerage emissions, policies and activities need to be synchronized. On issues where policies contradict each other, such as water allocations or land reclamation, efforts need to be harmonized. A tool for dealing with these more controversial subjects may be conflict resolution and mediation, which is increasingly being applied for water resource management issues. Finally, integration can occur when formal mechanisms ensure that policies are harmonized and implemented.

In order to improve coordination efforts at both the national and local levels, several steps or activities could be pursued.

*Activity 1.1 – Establish an inter-ministerial committee for the northern lakes.*

One of the major conclusions to emerge from the Port Said workshop was that a separate inter-ministerial committee needs to be established for the northern lakes. Because ministerial policies have great influence over the lakes, high-level decision need to ensure that the interests of the lakes are kept in mind. Committee membership needs to be broad to ensure that all activities that impact the lake are taken into consideration. Possible membership could include agriculture, water and irrigation, housing and sewerage, environment, justice, public health, transport, industry, planning, and finance. In addition, all the governorates surrounding the northern lakes need to participate. To encourage public participation, discussions should be open to stakeholder groups and NGOs, such as the fishermen's union, perhaps through the creation of a formal citizens advisory group. Current management structures adopted for Lake Nasser or the Chesapeake Bay in the United States (see box) can provide insight into possible institutional approaches that may be appropriate.

To tackle specific issues in the northern lakes, working groups could be created on topics such as water allocations, land reclamation, industrial pollution, sewerage, etc. To enhance the effectiveness of the council, it needs to be given authority within the bureaucratic structures to ensure that sectoral policies are harmonized. In addition, it could be chaired by someone representing a level of government that has authority to bring several ministries together. Several tasks could be pursued:

- i. One of the first tasks for the council could be to issue a statement of principles supporting the lakes' continued existence in the interest of Egypt's sustainable development. The statement could validate the importance of pursuing a strategy that considers the multiple needs of different stakeholder groups, and the need to adopt an integrated approach to manage the lakes. Gaining such an agreement from the concerned ministries would be an important step in acknowledging that the lakes' have national value.
- ii. Current drafts of the National Development Plan need to be reviewed so that new projects that may impact the lakes are identified. For programs that may be detrimental to the lakes, the committee would need to examine options and discuss how these threats could be reduced.
- iii. A legal and institutional analysis needs to be conducted to determine exactly which laws and decrees conflict with each other, and where legal and institutional gaps currently exist. Recommendations could be issued to address these gaps.

- iv. A needs assessment could be performed to determine the adequacy of existing resources (funds, trained staff, facilities) for managing the lakes. As part of this assessment, options could be explored to promote decision-making processes that are participatory.

#### A Model in Coordination: The US's Chesapeake Bay Commission

The Chesapeake Bay Commission was established in 1980 to assist the states of Maryland, Pennsylvania, Virginia and the federal government to cooperatively manage the Chesapeake Bay, which is the US' largest and most productive estuary. An advisory commission was convened to evaluate existing and proposed management structures and to make recommendations for strengthening coordination. The findings of the advisory commission's study -- that greater cooperation was needed -- had a direct impact on the goals and duties of the Chesapeake Bay Commission.

Legislation that created the Commission specified a number of goals and functions consistent with the advisory commission's recommendations:

- to assist the legislatures in evaluating and responding to mutual Bay concerns;
- to promote intergovernmental cooperation and coordination for resource planning;
- to promote uniformity of legislation where appropriate;
- to enhance the functions and powers of existing offices and agencies, and
- to recommend improvements in the management of Bay resources.

In following two decades, the Chesapeake Bay Commission has been a leader in environmental protection and restoration efforts for the bay. The commission has promoted policy initiatives in nutrient reduction, fisheries management, toxics remediation, pollution prevention, habitat restoration and land management. Monitoring data now show that as a result of the work of the Commission, various government agencies, the private sector, fishermen, and local communities working together to restore the estuary since 1983 has had a major impact. Large portions of the bay are cleaner now than they were 12 years ago. Highlights include:

- Industries showed a 67 percent reduction in toxic releases to the bay between 1988 and 1997.
- More than 400 million kilograms of waste was either reduced or recycled in 1998 by members of Businesses for the Bay program, a voluntary pollution prevention project.
- The Chesapeake Bay Partners Communities Program recognized 13 communities that took significant strides to protect local natural resources and the Chesapeake in 1999.
- Farmers practiced integrated pest management on 79 percent of bay area cropland.
- 11,000 acres of the bay were specially designated as aquatic reef habitat for oyster production.

#### *Activity 1.2 – Strengthen and expand membership of local lake committees*

The local lake committees provide an existing forum for coordinating programs and management activities in the lakes. They have been effective in several respects by ensuring that local authorities work together on various management issues. Their effectiveness, however, has been hampered by their limited authority to make management decisions and by the absence of several governmental and non-governmental sectors on the committee.

#### Tasks:

- i. Expand committee membership to all of the relevant government ministries, governorate offices, and non-governmental participants which impact the lakes. Together, priorities of common interest should be identified and pursued. To engage

interested citizens and facilitate vertical coordination, the lakes committee should consider setting up a citizen advisory committee as discussed in more detail under Activity 1.3.

- ii. Allocate sufficient financial and technical resources and ensure committee have sufficient authority to undertake appropriate management actions.
- iii. Promote community support and participation for protecting the lakes. A great deal of effort needs to be devoted to building public support for the lakes so that a constituency can be created over the long run for the lakes.
- iv. Create a working committee devoted exclusively to enforcing environmental and fisheries regulations. Many agencies are responsible for enforcing the law, and the lack of coordination means that violators go unpunished. One step to start this process could be bring all parties together to discuss how they can coordinate better on critical management areas. The development of a manual could help the different officials understand what each other needs are for law enforcement, and what laws and decrees pertain to different issues. In addition, protocols and procedures could be developed to bring about common understanding on the steps that are required by each ministry to implement the law.
- v. Support lake monitoring by local institutions. The National Institute of Oceanography and Fisheries, local GAFRD offices, and other local institutions need to better integrate their efforts to ensure that comprehensive monitoring is conducted regularly. In addition, local fishing cooperatives should assist with collecting various monitoring data. A centralized data base and information center for each lake would be invaluable for management.

***Activity 1.3 – Strengthen local and national non-governmental and resource user participation in lake management.***

Protecting the lakes will inevitably depend on political and social will. Creating this will requires building a coalition of citizens to support the lakes, increasing public and government awareness about their value, and maximizing the economic potential of their natural resources. Achieving active participation from fishermen, local scientists, environmentalists, public health specialists, university students, and other concerned citizens will go a long way to form an organized constituency group that can advocate policies on the lakes' behalf. These groups are natural allies. In the past, however, efforts to bring fishermen, NGOs, and other people together have occurred only in response to a crisis. Through a formal mechanism, such as a citizen advisory committee, local NGOs and universities can play a meaningful role in harmonizing competing interests of various stakeholders and providing specialized expertise within different issues. In addition, working in partnership with local stakeholders will help ensure local ownership of policies over the lakes, which will enhance their implementation.

**Tasks:**

- i. Establish a citizens advisory group to achieve a partnership between different

organizations that have a common interest in saving the lakes. These organizations could include the Fishery Union and local cooperatives, national and local environmental NGOs, scientists, university groups, medical associations, and local community leaders. Together, they can work together and build on their own comparative advantages in the policy formulation process to save the lakes.

ii. Launch a public awareness and environmental education campaign to increase support for the lakes. Public awareness and environmental education can encompass a wide range of activities:

- increasing attention on the lakes in the media,
- holding public consultations with community leaders and citizens,
- sponsoring an information/nature center with newsletters and educational programs,
- ensuring the lakes are integrated into local school curricula,
- sponsoring "practical exercises" to increase interest in the lakes,
- publishing educational materials, and
- setting aside a part of each lake for educational purposes and nature tours.

## **OBJECTIVE 2 – CEASE ALL LAND RECLAMATION**

Land reclamation has already claimed nearly 60 percent of the lakes and threatens to completely dry over Maryut, Idku, and Manzala. Although GARPAD has officially announced that it will not support any new reclamation projects in the northern lakes, other interests exist in favor of continued reclamation for urban and infrastructure development, as well as for agriculture. Because this issue is very controversial, further dialogue and even exercises in conflict resolution may be useful.

### ***Activity 2.1 – Develop a baseline map for each lake.***

No accurate maps currently exist of the lakes that would permit local officials to determine whether any new drying has occurred. A baseline map of each lake needs to be developed to determine the current area and borders of the lakes.

### ***Activity 2.2 – Issue a decree from the Ministry of Agriculture and Inter-Ministerial Committee on the Northern Lakes to forbid further drying.***

The confused legal environment on this subject requires an unequivocal statement from high-level decision makers forbidding more land reclamation. As part of the policy formulation, an economic and social impact analysis could be conducted to determine the real cost verses benefits of lake drying. This analysis needs to consider such issues as the capital investments required for land reclamation, the opportunity cost of using freshwater on saline delta soils, the dislocation of fishing communities, etc.

### ***Activity 2.3 – Review and modify approved drying schemes***

Although no new land reclamation projects are envisioned by GARPAD, existing programs will still reclaim new land in the lake. Options should be explored on how to redesign these current projects to reduce their impact on the lakes.

*Activity 2.4 – Review and modify future plans for drying.*

Future plans from all relevant ministries (not just from GARPAD) and the governorates needs to be reviewed to ensure that no new roads, industries, housing projects, etc. are planned on the lakes requiring land reclamation.

*Activity 2.5 – Establish procedures for identifying and penalizing violators*

When drying does occur, a system to identify and penalize violators needs to be developed as a disincentive to future drying.

### OBJECTIVE 3 – MAINTAIN SUFFICIENT WATER ALLOCATIONS

The imminent diversion of most of Lake Manzala's good quality freshwater to the El Salaam canal for the North Sinai project will cause a major change to lake's basic ecological functions. Ensuring that all the northern lakes receive a minimum flow required to maintain basic ecological processes must be one of the highest short-term priorities.

*Activity 3.1 – Achieve consensus on long-term allocations for lakes, and identify appropriate actions (ie, dredging canals, policy)*

The MWRI is currently formulating its 2002 – 2017 National Development Plan in which projections and scenarios are being developed to determine future Nile water allocations. To date, the northern lakes and the environment are not factored in water budgeting. With the construction of the North Sinai and Toshka projects underway, future freshwater allocations for the northern lakes will be drastically reduced. No plans are underway to mitigate the environmental impacts. Urgent attention needs to focus on what can be done to ensure that the lakes receive their minimal required flows.

Tasks:

- i. Obtain draft water allocation plan from Ministry of Water Resources and Irrigation for 2002 – 2017.
- ii. Based on best available information, determine the minimal requirements of freshwater to maintain ecological functions for fisheries and other environmental services.
- iii. Identify policy options for ensuring that the northern lakes receive at least this minimal requirement. Several policies options could be examined:
  - Changing the MWRI's current classification of the northern lakes from an outflow to the Mediterranean Sea to an agricultural use requiring sufficient freshwater.
  - Examining whether alternative sources of freshwater can be obtained, perhaps from the Damietta branch of the Nile, to compensate for water diverted to the North Sinai. Ensure that the environmental impacts of diverting water from the Damietta branch are examined carefully.

### OBJECTIVE 4 - MITIGATE THE IMPACTS OF POLLUTION

In the short to medium run, the northern lakes will continue to receive high loads of wastewater that will reduce water quality and fish production. GARFD's program to remove vegetation from the lakes to enhance water circulation is having a positive impact. However, current activities are still modest in relation to the need. Several steps still need to be taken for the effects of pollution to be mitigated.

***Activity 4.1 - Identified priority actions based on severity of threat***

GARFD has drafted a list of priority actions for each lake in its strategy. The team recommends that these actions be implemented, with priority placed on the following tasks:

- i. Dredge drainage canals and lake bottom to enhance water circulation and increase water depth.
  - Priority canals are el Gamiel and el Qabuti in Lake Manzala.
  - Dig divergent canal from el Umum drain to allow cleaner agriculture drainage water into the 6,000-feddan basin for Lake Maryut
- ii. Remove vegetation clogging the canals. In addition, investigate the possibility of preventing water hyacinth from entering the lakes from drainage canals by installing a screening system. The vegetation that is extracted should be removed from the lake so that it does not decompose and add to organic loads.
- iii. Install aerators in strategic locations to combat anaerobic conditions to aid in the treatment of wastewater.

***Activity 4.2 - Identify and secure financial resources to implement actions.***

GARFD's current strategy to improve environmental quality costs in the range of LE 27.9 million (US\$8.2 million). Because the northern lakes provide on the order of hundreds of millions of dollars in primary and secondary wastewater treatment services for Alexandria, Cairo, Damietta, and numerous other cities and towns, a user fee could be established to help pay for maintaining the lakes. Improving the lakes' ability to treat current sewerage loads would benefit the citizens of the northern lakes and Mediterranean Sea, where effluents eventually flow.

***Activity 4.3 - Monitor key water quality parameters with sufficient frequency***

It is critical to monitoring key water, fishery, and other parameters so that efforts to improve environmental quality can be assessed for their success. Current monthly monitoring of basic indicators by GARFD may need to be expanded. In addition, opportunities for partnerships may arise with the Institute of Oceanography and Fisheries, local universities, Ministry of Public Health, Ministry of Housing and Sewerage, and the governorates to establish a unified monitor system that builds on areas of common interest. A centralized data based and information center would aid in having readily accessible information.

**OBJECTIVE 5 - REDUCE EFFLUENTS FROM PRIORITY POINT SOURCES**

The assessment finds that certain industrial and municipal point sources of pollution are more

harmful than others. For example, fishermen of Lake Maryut complain specifically about periodic effluents from the oil refineries and the sulfur transfer station. While the EEAA has conducted an inventory of existing factories, at least for Maryut, it is unclear whether a list of priority factories and sewerage drains has been prepared for future action. Focussing on the worst polluters for the short-term will provide the most environmental benefit for each unit of effort.

*Activity 5.1 – Establish a protocol for working with relevant public agencies*

The problem of industrial and municipal pollution is cross cutting and involves several agencies, including the ministries of environment, industry, housing and sewerage, and water and irrigation. To date, a major handicap has been fragmentation of the different agencies and decision making. To begin to overcome this problem, a protocol or memorandum of understanding should be signed to establish a working relationship between relevant agencies. In addition, several donor-funded projects, such as the SEAM project, USAID's Egyptian Environmental Policy Program, and USAID's environmental education program under GREENCOM, which focus on industrial pollution prevention and control, could be contacted to coordinate efforts.

*Activity 5.2 – Update the inventory of current point sources and identify pollution hotspots for priority action.*

Some baseline information may need to be collected before priorities can be determined. All point sources of pollution need to be identified, their effluents described, and current form of waste treatment determined. Based on this information, a priority setting exercise involving the government, NGOs, and the private sector could be conducted to identify which factories will be the focus of efforts for the short term.

*Activity 5.3 – Inspect priority industries and pursue appropriate action to reduce discharges.*

The EEAA has responsibility for inspecting industries. Options for reducing pollution need to remain flexible and opportunities to achieve economic benefits through improved efficiencies need to be pursued. The opportunity to provide technical and financial assistance to these priority industries to help them adopt cleaner technologies, whether for waste minimization, source reduction, or recycling, needs to be explored.

## **OBJECTIVE 6 – SUPPORT SUSTAINABLE FISHERY PRODUCTION**

Ultimately, achieving higher earnings from the lakes' resources will be a powerful argument to use for defending them. Maximizing the economic potential of fisheries and the lakes' biodiversity will make competing uses less attractive. Although the northern lakes have been under severe environmental pressure for years, they still have considerable potential for increased fish production and recreational use. Mitigating pollution is critical, as is ensuring minimum freshwater flows are maintained. However, overfishing and destructive fishing threaten the long-term viability of the fishery.

*Activity 6.1 – Strengthen local fishing cooperatives.*

The cooperatives are in a good position to provide technical assistance, training, and financing to fishermen. Although they already provide a range of social services to the

community, they are underfinanced and limited in their ability to work to increase the profitability of the lake fishery.

Tasks:

- i. Provide technical assistance and training to the fishing cooperatives for institutional building. Areas to be covered could include financing, providing training to fishermen, increasing profitability through marketing and fish processing, extension, environmentally-sound fishing approaches, etc.
- ii. Provide a grant to the cooperatives to launch an awareness campaign and extension services to fishermen to promote greater understanding on the importance of conserving fish resources and the environment for their future. Options for promoting more sustainable fishing techniques need to be disseminated.
- iii. Conduct an inventory and/or socio-economic survey of the number of fishermen and boats operating in the lakes in order to monitor the impacts of a fishery program on the community's welfare.

***Activity 6.2 – Examine options for improving property rights over fish resources.***

A priority needs to be placed on exploring what options are available to improve the current system of property rights for the lakes. The current system is leading to the privatization of the lakes' resources for fish farming at the expense of subsistence fishermen. Perhaps developing a management approach that rests on granting private fishing rights to traditional fishing communities and cooperatives could be a step in the right direction. This approach would address issues of equity over resources, and provide long-term incentives for communities to be more concerned with the sustainability of their practices. In addition, it could help limit access to only members of the cooperative, thereby reducing fishing effort.

***Activity 6.3 – Increase profitability of fishing in the northern lakes.***

Overfishing and illegal fishing would not be so rampant if fishermen were able to make a decent living. The pressure to overfish and use illegal methods is driven in part by desperation. Options need to be examined on how fishermen can earn more money from each kilogram of fish caught. Adding value to their catch, whether through providing access to refrigerator services or by giving local cooperatives a greater role in marketing fish products, would be important step to help fishermen increase their income.

***Activity 6.4 – Enforce fishery laws.***

The laws against illegal fishing must be enforced if the fish of the northern lakes are to reach their maximum productivity. Steps need to be worked out with the local lake committees, fishing cooperatives, and the local citizens to seek mutually acceptable solutions on how fishery laws can be better enforced. Several options to start are available:

- Ensure local environment and water police have adequate equipment to pursue violators.
- Provide training to local courts on how to prosecute cases against fishing and environmental laws.

- Involve fishing cooperatives and the community in helping to enforce the laws. For example, designate local enforcement monitors in each community, who can initiate or transmit complaints of violations to the lake police.
- Consider setting up a no-take zone that would give fish a sanctuary for reproduction and growth.

## **OBJECTIVE 7 – CONSERVE BIODIVERSITY**

The biological diversity of the lakes is of importance to the Black Sea/Mediterranean region and to Europe. Given the present decline of the lakes and the need to find economic approaches to justify their continued existence, an effort should be launched to promote eco-tourism for national and international visitors. Foreign naturalists and bird-watchers desire to travel to remote areas to see birds and beautiful landscapes. The opportunity to put the northern lakes on the itinerary of tourists already coming to Egypt and the Mediterranean Sea should be explored. The establishment of a no-take zone would not only help in fish production, but also support conservation goals.

### **Medium – Term Actions for Integrated Management of the Northern Lakes**

While several measures need to be taken immediately to address urgent threats to the lakes, over the medium to long term, a more coherent approach is needed to promote the lakes' restoration and to fully maximize their economic potential through environmentally-sound approaches. To ensure that the long-term goals of the lakes are reached through a systematic and integrated perspective, the assessment team recommends that a comprehensive management planning process be launched. The purpose of this planning process would be two-fold: achieve consensus from stakeholders on future policies and activities in the lakes, and provide a simplified "road map" to deal with the very complicated and dynamic situation. To finance the preparation and implementation of the management plan, the Government of Egypt could request technical and financial assistance, perhaps through a stand-alone project, from USAID or other donors.

The development of a management plan for the lakes would actually be part of a broader process that is commonly accepted throughout the world to support integrated management of coastal resources. Table 7 provides an overview of this process. Over the long term, the presence of a management plan that is developed and implemented through a transparent, participatory consensus-building process will go a long way to help focus future programs in the same direction to achieve mutually-reinforcing goals. The aim of such a plan, and indeed future management efforts, should be to promote fisheries and development of the lakes' natural resources and environmental services in a way that benefits the people of Egypt today and for future generations.

Within this planning process, several issues and plans could be the focus:

- Land-use/Zoning plan for lakes.
- Plan to improve fish management
- Plan for sewerage treatment
- Plan for industrial pollution prevention

- Plan for reducing solid wastes
- Plan for increasing public awareness and environmental education
- Plan for promoting recreational uses and tourism
- Plan to maintain hydrologic balance
- Plan for biodiversity conservation
- Plan for improving institutional mechanisms, laws and regulations
- Plan for use of economic policy instruments, cost recovery, and financing lake management (see Annex A for more details).

Regulatory and economic instruments would also need to be explored. For example, a policy could be adopted requiring all projects and programs that impact the lakes to undergo an environmental impact assessment that must be reviewed by the local lakes committee, citizens advisory committee, and the inter-ministerial committee. Economic instruments also could be pursued as a way to introduce incentives to protect the lakes, as described in Annex A. For example, the cities of Cairo, Alexandria, and Damietta could support a general fund for lake management as compensation for the wastewater treatment services provided by the lakes.

Table 7.

Step	Essential Actions ✓
Step 1: Issue Identification and Assessment	<ul style="list-style-type: none"> <li><input type="checkbox"/> Identify the major stakeholders and their interests.</li> <li><input type="checkbox"/> Assess the principal environmental, social and institutional issues and their implications.</li> <li><input type="checkbox"/> Identify the causal web linking human uses, natural processes and adverse coastal conditions.</li> <li><input type="checkbox"/> Select the issues upon which the management initiative will focus its efforts.</li> <li><input type="checkbox"/> Define the goals of the coastal management initiative.</li> </ul>
Step 2: Preparation of The Plan	<ul style="list-style-type: none"> <li><input type="checkbox"/> Conduct selected scientific research.</li> <li><input type="checkbox"/> Document baseline conditions.</li> <li><input type="checkbox"/> Develop the management plan and the institutional framework by which it will be implemented.</li> <li><input type="checkbox"/> Create staff and institutional capacity for implementation.</li> <li><input type="checkbox"/> Design the institutional structure and decision-making processes for plan implementation.</li> <li><input type="checkbox"/> Test implementation strategies at a pilot scale.</li> <li><input type="checkbox"/> Conduct a public education and awareness program.</li> </ul>
Step 3: Formal Adoption and Funding	<ul style="list-style-type: none"> <li><input type="checkbox"/> Obtain governmental approval for a planning and policy formulation process.</li> <li><input type="checkbox"/> Obtain formal endorsement of policies/plan and the authorities necessary for their implementation.</li> <li><input type="checkbox"/> Obtain the funding required for program implementation.</li> </ul>
Step 4: Implementation	<ul style="list-style-type: none"> <li><input type="checkbox"/> Implement mechanisms for inter-agency coordination and conflict resolution procedures.</li> <li><input type="checkbox"/> Implement regulations and decision-making procedures.</li> <li><input type="checkbox"/> Strengthen program managerial capacity.</li> <li><input type="checkbox"/> Catalyze the construction and maintenance of necessary physical infrastructure.</li> <li><input type="checkbox"/> Encourage participation of major stakeholder groups.</li> <li><input type="checkbox"/> Maintain the program's priority on the public agenda.</li> <li><input type="checkbox"/> Monitor program performance and societal ecosystem trends.</li> <li><input type="checkbox"/> Adapt the program to its own experience and to changing environmental, political and social conditions.</li> </ul>
Step 5: Evaluation	<ul style="list-style-type: none"> <li><input type="checkbox"/> Evaluate and adjust program as necessary</li> </ul>

Source: University of Rhode Island.

Over the long term, the presence of a management plan that is developed and implemented through a transparent, participatory consensus-building process will go a long way to help focus future programs toward mutually-reinforcing goals. The use of economic instruments will promote greater efficiencies. The aim of such a plan, and indeed future management efforts, should be to promote fisheries and development of the lakes' natural resources and environmental services in a way that benefits the people of Egypt today and for future generations to come.

## Annex A.

### Environmental Policy Instruments

In Egypt, regulatory instruments (laws, regulations, government decrees, etc) have been the primary vehicle for managing the country's natural resources. These instruments have often had a monetary component attached to them in the form of fines or disciplinary measures (see Table 8). Unfortunately, experience with these regulatory instruments has been poor. The instruments have been inefficient, particularly in promoting clean technologies and new pollution control processes. Furthermore, they have not generated the funds required to promote environmental and resource management objectives. In addition, they have not encouraged polluters to improve their operations.

Table 8. Current Fines Available for Lake Management

Fines for water protection.	Fines are collected in accordance with Law 48/1982 for the River Nile and other water channels protection. All firms, institutions and individuals that discharge wastewater, sewerage or other poor quality water must pay these fines. Earnings from the fines are used to establish wastewater treatment plants, cover the cost of pollutants removal, and reward inspectors
Fines for water resources management.	Fines are based on articles no. 157-159 of Law 48 /1982 and are designed to insure the proper use of water resources. Earnings are used for the same purposes mentioned for water protection.
Fines for rezoning agricultural land	Based on Law 53/1966, these fines are designed to reduce fertility loss of soils.

The use of economic instruments to encourage environmentally sound management practices has been accepted around the world as an effective approach to achieve economic efficiencies as well as environmental sustainability. In the Mediterranean, the use of economic instruments has gained a successful track record in achieving meaningful and rapid environmental improvement. Economic instruments can be labeled "economic" insofar as they affect estimates of cost and benefit. Economic instruments leave actors free to respond to a certain stimuli in away they themselves think most beneficial.

Charges and resource pricing, subsidies, deposit-refund system, market creation and financial enforcement incentives are all types of economic instruments. Most often used economic instruments in practice are charges, while other types of instruments are not well known and they're not often applied in Egypt. Charges are applied in the areas of water resources protection, solid waste disposal, conservation of fisheries, and land conservation. It is estimated that economic instruments will have great importance in the future.

Experiences gained so far suggest that economic instruments provide a number of advantages when mixed with regulatory instruments:

- They can produce substantial cost saving by giving polluters the freedom to select the most appropriate approach for meeting standards.

- They provide ongoing incentives to reduce pollution below levels required by regulations and for resource conservation.
- They encourage new technologies in pollution control and production processes.
- They provide flexibility for government authorities and polluters.
- They provide a source of financing for specific environmental programs.

Many types of economic instruments exist, as highlighted in table x. In the northern lakes, several factors point to a favorable climate for adopting some of these economic instruments for environmental management. The area is densely populated and has a great deal of economic activity. The economic well-being of the northern delta provides the ability to polluters and resource users to adopt a system of economic incentives for the environment and fisheries.

<b>Charges and Resource Pricing</b>	
<b>Effluent or pollution charges</b>	Imposed in accordance with environmental discharges and are based on the quality and/or quantity of pollutants released. They are most widely applied to control water pollution.
<b>User charges</b>	Mostly used in pollution control as well as resource management. For pollution control, user charges are applied as payments for the cost of collective public treatment of effluent and waste, as in the case of collection and disposal of solid waste. For resource management, these charges are applied as payments for the use of the resource, such as for freshwater uses.
<b>Produce charges</b>	Added to the price of a product that either in the process of manufacturing, utilization, or disposal, creates pollution. Examples include charges on various types of fuel, containers, pesticides and fertilizers.
<b>Administrative charges</b>	Payments for the enforcement and implementation of regulations, such as registration fees for certain kinds of chemicals.
<b>Deposit-refund Systems</b>	Imposes refundable charge on potentially polluting products, such as food and drink containers.
<b>Tax differentiation</b>	A tool to determine more favorable prices for environmentally friendly products or vice versa. In this context, tax differentiation can be considered as negative or positive product charges.
<b>Subsidies</b>	
<b>Grants</b>	Grants are repayable straight out financial transfers of government funds to polluters.
<b>Loans</b>	Soft loans are repayable with favorable terms such as low interest rates or long repayment periods.
<b>Tax allowances</b>	Tax allowances can provide incentives to reduce pollution control expenditures.
<b>Market creation</b>	
<b>Emission trading</b>	A pollution discharger can sell its pollution "right" if it discharges below allowable standards, and the buyer can purchase this right to discharge over allowable standards discharge. Added together, discharge by the seller and buyer meet standards.
<b>Market intervention</b>	Aim to maintain or establish markets for residual products, such as low freight for transporting waste material and assistance for a waste exchange markets.
<b>Financial enforcement incentives</b>	

Non-compliance fees	Applied for failing to comply with regulations. The fees are determined in accordance with the financial benefit gained through non-compliance.
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However, several pre-conditions are necessary for economic instruments to be successful:

- Integration and harmonization of development policy as well as with other relevant instruments.
- Functioning market system within which economic instruments can operate effectively.
- Sufficient level of environmental knowledge.
- Institutional and enforcement mechanism to calculate, impose, collect and spend earnings from fees.

The money collected is paid into environmental/conservation fund(s) and earmarked for specific environmental expenditures in the area of collection. Over the medium term, policy makers should strive to meet these pre-conditions so that economic instruments can be adopted as a efficient tool for improving environmental management of the northern lakes.

## Annex B. - Matrix of Threats to Lakes Manzala and Maryut

### Threat Analysis for Lake Maryut

Threat	Cause	Impact	Mitigative Measures
Land reclamation	Economic pressure to reclaim lake for urban and agricultural development. Currently, 30,000 feddans are at risk of being reclaimed for agriculture in the future.	<ul style="list-style-type: none"> <li>• Decreased lake area from 59,000 feddans in 1958 to between 15,000 and 17,000 in 2000.</li> <li>• Reduced water volume</li> <li>• Habitat loss for fish production</li> <li>• Increased concentration of fishing effort</li> <li>• Reduction of migratory birds and other biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Place a permanent moratorium on drying</li> <li>• Build public support to save the lake</li> <li>• Draft land-use plan to gain consensus on permissible resource uses.</li> </ul>
Eutrophication due to the discharge of untreated or partially treated municipal wastewater	Untreated or partially treated municipal waste discharged daily from the following drains including 800,000m <sup>3</sup> from El Kalaa	<ul style="list-style-type: none"> <li>• Sedimentation and siltation</li> <li>• Reduced water depth and volume</li> <li>• Excessive reed and water hyacinth growth</li> <li>• Oxygen depletion</li> <li>• Exposure to pathogens</li> <li>• Contributes to lake's poor public image</li> <li>• Loss of biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Technical responses:                             <ul style="list-style-type: none"> <li>- dredge lake bed</li> <li>- clear reeds entirely from lake,</li> <li>- install aerators,</li> <li>- increase dilution with clean water,</li> <li>- improve water flow</li> </ul> </li> <li>• Install at least primary treatment of all waste, and go forward with Phase II of the Alexandria wastewater treatment plan</li> <li>• Consider constructing an engineered wetland</li> <li>• Draft plan to accommodate future sewerage needs for population growth.</li> </ul>
Presence of toxic chemicals due to discharge of untreated industrial waste, lead gasoline, and improper handling of certain chemicals (ie, sulfur).	<ul style="list-style-type: none"> <li>• Untreated or partially treated industrial waste discharged daily.</li> <li>• Unidentified factories discharge hazardous chemicals harmful to human health (arsenic, beryllium, dichloroethane, tetrachloroethane)</li> <li>• Law 4 difficult to enforce</li> </ul>	<ul style="list-style-type: none"> <li>• Public health threat</li> <li>• Decreased fish quality and quantity</li> <li>• Contributes to lake's bad public image</li> <li>• Loss of biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Enforce Law 4 in highly polluting industries</li> <li>• Provide technical and financial assistance to high priority industries</li> </ul>
Overfishing and illegal fishing	<ul style="list-style-type: none"> <li>• Reductions of lake area and poor water quality have led to greater fishing effort per unit area</li> </ul>	<ul style="list-style-type: none"> <li>• Decreased fish productivity and sustainability</li> <li>• Loss of biodiversity</li> <li>• Loss of protein source for low-income Egyptians</li> <li>• Importation of fish to compensate for loss of fish production</li> </ul>	<ul style="list-style-type: none"> <li>• Improved fish management through extension</li> <li>• Give cooperatives greater role in promoting and regulating fishing.</li> <li>• Explore approaches for improving property rights.</li> <li>• Enforce existing laws</li> <li>• Increase earnings from fishing</li> <li>• Control fishing effort.</li> <li>• Identify no-take zone for fish replenishment</li> </ul>
Improper solid waste disposal	<ul style="list-style-type: none"> <li>• Lack of a proper landfill for disposing of</li> </ul>	<ul style="list-style-type: none"> <li>• Hazardous chemicals leaching into lakes</li> </ul>	<ul style="list-style-type: none"> <li>• Re-site current landfill away from lake</li> </ul>

	<p>Alexandria's solid waste</p> <ul style="list-style-type: none"> <li>Lack of enforcement of anti-dumping laws</li> </ul>	<ul style="list-style-type: none"> <li>Ash from burned garbage dumped into lakes</li> <li>Dumped waste obstructs water flow</li> <li>Public health threat</li> <li>Aesthetically unpleasant</li> </ul>	<ul style="list-style-type: none"> <li>Penalize illegal dumping.</li> <li>Launch a public awareness campaign to stop littering and illegal dumping.</li> </ul>
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## Threats Analysis for Lake Manzala

Threat	Cause	Impact	Mitigative Measures
Significant reduction in freshwater drainage entering the lake	Current and future water diversion to the El Salam drain for the Northern Sinai project and for Toshka. Projection reductions of 2 billion m <sup>3</sup>	<ul style="list-style-type: none"> <li>• Significant increase in pollution</li> <li>• Significant Increase in salinity</li> <li>• Dramatic changes to lake's biological communities</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure adequate freshwater allocations are maintained.</li> <li>• Identify possible new freshwater sources.</li> </ul>
Lake drying and privatization	Economic pressure to convert lake for <ul style="list-style-type: none"> <li>• urban and industrial development,</li> <li>• agriculture,</li> <li>• fish farming, and</li> <li>• road construction</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced fish productivity</li> <li>• Decreased lake area from 407,000 feddans in the 1930s to 130,000 today.</li> <li>• Reduced water volume</li> <li>• Lower fish production</li> <li>• Loss of biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Place permanent moratorium on drying</li> <li>• Examine legal response to arrest drying.</li> <li>• Building public support for saving the lake</li> <li>• Draft land-use plan</li> </ul>
Eutrophication due to the discharge of untreated or partially treated municipal wastewater	<ul style="list-style-type: none"> <li>• Untreated or partially treated municipal waste discharged daily from the following drains, including 1.35 million m<sup>3</sup> daily from Bahr el Baqar.</li> </ul>	<ul style="list-style-type: none"> <li>• Sedimentation and siltation</li> <li>• Reduced water depth and volume</li> <li>• Excessive weed growth</li> <li>• Oxygen depletion</li> <li>• Excessive exposure to pathogens</li> <li>• Contributes to Manzala's bad public Image</li> <li>• Reduction of migratory birds and other biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Technical responses:                             <ul style="list-style-type: none"> <li>- Dredge lake bed</li> <li>- Clear reeds entirely from lake,</li> <li>- Install aerators,</li> <li>- Increase dilution with clean water,</li> <li>- Improve water flow</li> </ul> </li> <li>• Install and/or upgrade wastewater treatment for Damietta, Cairo, and other key municipalities</li> <li>• Support UNDP reconstructed wetland project</li> </ul>
Improper fishing practices: overfishing, illegal fishing, and privatization of the lake	<ul style="list-style-type: none"> <li>• Decline in lake area and water quality has led to greater fishing effort per unit area</li> <li>• Introduction of fishing "mafias"</li> </ul>	<ul style="list-style-type: none"> <li>• Decreased fish productivity and sustainability.</li> <li>• Loss of protein source for low-income Egyptians</li> <li>• Reduction of migratory birds and other biodiversity.</li> </ul>	<ul style="list-style-type: none"> <li>• Improved fish management through extension</li> <li>• Give cooperatives greater role in promoting and regulating fishing.</li> <li>• Increased value of fish</li> <li>• Explore approaches for improving property rights.</li> <li>• Enforce existing laws, including the increase of resources for policing.</li> <li>• Identify no-take zone for fish replenishment</li> <li>• Control fishing effort.</li> </ul>
Inadequate water exchange with the Mediterranean Sea	<ul style="list-style-type: none"> <li>• Road construction blocked off water exchange between lake and sea,</li> <li>• Sea inlets are silting up.</li> </ul>	<ul style="list-style-type: none"> <li>• Water stagnation and poor water quality</li> <li>• Decreased salinity</li> <li>• Decline of Mediterranean species entering the lake, leading to significant change in the species composition of the fishery.</li> </ul>	<ul style="list-style-type: none"> <li>• Construct appropriate works (culverts and drains for new road, inlets for the entire road) to improve water exchange.</li> <li>• Dredge silted inlets.</li> </ul>

<p><b>Presence of toxic chemicals due to discharge of untreated industrial waste</b></p>	<ul style="list-style-type: none"> <li>• Untreated or partially treated industrial waste discharged daily.</li> <li>• Unidentified factories discharge hazardous chemicals harmful to human health</li> <li>• Law 4 difficult to enforce</li> </ul>	<ul style="list-style-type: none"> <li>• Public health threat</li> <li>• Decreased fish quality and quantity</li> <li>• Contributes to lake's bad public image</li> <li>• Reduction of migratory birds and other biodiversity.</li> </ul>	<ul style="list-style-type: none"> <li>• Enforce Law 4 in highly polluting industries</li> <li>• Provide technical and financial assistance to high priority industries</li> </ul>
<p><b>Improper solid waste disposal</b></p>	<ul style="list-style-type: none"> <li>• Lack of a proper landfill for disposing of solid waste for surrounding municipalities</li> <li>• Lack of enforcement of anti-dumping laws</li> </ul>	<ul style="list-style-type: none"> <li>• Hazardous chemicals leaching into lakes</li> <li>• Ash from burned garbage dumped into lakes</li> <li>• Dumped waste obstructs water flow</li> <li>• Public health threat</li> <li>• Aesthetically unpleasant</li> </ul>	<ul style="list-style-type: none"> <li>• Re-site current dumping grounds away from lake</li> <li>• Penalize illegal dumping.</li> <li>• Launch a public awareness campaign to protect the lake.</li> </ul>

## Annex C

### Common Fish Species of Northern Lakes

	Scientific name	English name
1	<i>Oreochromis niloticus</i>	Nile Tilapia
2	<i>Oreochromis aureus</i>	Blue tilapia
3	<i>Sarotherodon galileus</i>	Saint Peter fish
4	<i>Tilapia zilli</i>	Green tilapia
5	<i>Haplochromis desfontainesii</i>	Blue Cichlid
6	<i>Hemichromis binaculatus</i>	Jewelry Cichlid
7	<i>Lates niloticus</i>	Nile perch
8	<i>Labeo niloticus</i>	Nile carp
9	<i>Anguilla anguilla</i>	Eel
10	<i>Atherina boyeri</i>	Silver side
11	<i>Bagrus bayad</i>	Catfish
12	<i>Bagrus docmac</i>	Catfish
13	<i>Barbus bynni</i>	Barbus
14	<i>Barbus perince</i>	Barbus
15	<i>Clarias lazera</i>	African catfish
16	<i>Clarias anguillaris</i>	Catfish
17	<i>Cyprinus carpio</i>	Common carp
18	<i>Labeo coubie</i>	Labeo
19	<i>Synodontis schall</i>	Catfish
20	<i>Synodontis serratus</i>	Catfish
21	<i>Mugil cepalus</i>	Gray mullet
22	<i>Liza ramada</i>	Thin-lipped mullet
23	<i>Liza aurata</i>	Gold ear mullet
24	<i>Liza salinus</i>	Thick lipped mullet
25	<i>Chrysichthys ruepelli</i>	Catfish
26	<i>Dicentrarchus labrax</i>	Seabass
27	<i>Dicentrarchus punctatus</i>	Spotted Seabass
28	<i>Sparus auratus</i>	Gilthead seabream
29	<i>Hemiraphus sp.</i>	Halfbeak
30	<i>Solea solea</i>	Common sole
31	<i>Sciena aquilla</i>	Meager
32	<i>Dalphis imperbis</i>	Green eel

## Annex D.

### Contact List

<b>Lake Maryut - Alexandria</b>	
Abou Shouk, Fatma	Alexandria Regional Branch Egyptian Environmental Affairs Agency (EEAA)
Abu Zahra, Adel	Friends of the Environment, Alexandria
Aleem Okasha, Abdel	West Delta Drainage Ministry of Water and Irrigation
Ali Al-Ziawi, Saed Ahmad	Fisherman
Ali El-Swaf, Mamdouh	Police Unit Department of Interior
Al-Sayadeen, Shiekh	Fisherman
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## Annex E.

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